PROCEEDINGS *of the* HAWAIIAN ENTOMOLOGICAL SOCIETY *for* 1955

VOL. XVI, No. 1
JULY, 1956

Suggestions for Manuscripts

Manuscripts should be typewritten on one side of standard-size white bond paper, double or triple spaced, with ample margins. The sheets should not be fastened together; they should be mailed flat. Pages should be numbered consecutively. Inserts should be typed on separate pages and placed in the manuscript in the proper sequence.

Footnotes should be numbered consecutively and inserted in the manuscript immediately below the citation, separated from the text by lines. They should be used only where necessary.

All names and references should be checked for accuracy, including diacritical marks. Authors' names must be spelled out when first mentioned.

Illustrations should be planned to fit the type page, 4½x7 inches. They should be drawn to allow for at least one-third reduction. Each should be labeled on the back with the author's name and title of the paper, as well as the number of the figure referred to in the text. Where size or magnification is important, some indication of scale should be given. They should be numbered consecutively, using letters to indicate parts of a composite figure. Legends should be typed on a separate sheet of paper and identified by the figure number.

Tables and graphs should be used only where necessary and omitted if essentially the same information is given in the paper. Graphs and figures should be drawn in India ink on white paper, tracing cloth, or light blue cross-hatched paper.

Proofs should be corrected as soon as received and returned to the editor with the abstract on forms provided. Additional costs to the Society for correction of authors' changes in proofs may be charged to authors. An order for reprints should be placed when proofs are returned. No gratis copies of reprints are supplied.

Examination of articles in this issue will help in conforming to style of presentation desired.

PROCEEDINGS

of the

Hawaiian Entomological Society

VOL. XVI, NO.1 FOR THE YEAR 1955 JULY, 1956

JANUARY 7, 1955

The 589th meeting was held at the H.S.P.A. Experiment Station on Friday, January 7, at 2:00 P.M., with Vice-President Van Zwaluwenburg in the chair.

Members present: Adachi, Balock, Barker, Beardsley, Bianchi, Boyle, Carter, Chilson, Chong, Christenson, Clagg, Fullaway, Haramoto, Ito, Joyce, Keck, Keiser, Krauss, Look, Maehler, Namba, Nishida, Pemberton, Rainwater, Rosa, Sakimura, Schmidt, Sherman, Steiner, Suehiro, Tanada, and Weber.

Visitors: Q. C. Chock, J. I. Mason, Setsuko Nakata, C. E. Parsons, and H. I. Rainwater.

Miss Setsuko Nakata was unanimously elected to membership in the Society.

Dr. Albert R. Mead, Professor of Zoology at the University of Arizona, spoke on his recent work in Ceylon on *Achatina fulica* and other land snails. He dwelt particularly upon an unreported disease of snails which he discovered in Ceylon and which he had just found present in Hawaii.

NOTES AND EXHIBITIONS

ICERYA PURCHASI Maskell: Mr. Van Zwaluwenburg reported that Dr. H. L. Lyon had shown him branches of *Malipighia punicifolia* L. from Maunawili, Oahu, which were infested with the cottony cushion scale. This appears to be an unrecorded host plant for this insect.

TEFFLUS ZANZIBARICUS ALLUAUDI Sternberg: Mr. Krauss stated that Dr. P. Basilewsky of Tervuren, Belgium, had given him this name for the large black carabid from Kenya recently liberated in Hawaii to combat the giant African snail and previously referred to in these "PROCEEDINGS"[1] as *Tefflus hacquardi* de Chaudoir.

[1] Throughout this publication, "PROCEEDINGS" refers to the PROCEEDINGS OF THE HAWAIIAN ENTOMOLOGICAL SOCIETY.

DIACHUS AURATUS (F.): Mr. Krauss stated that several adults of this chrysomelid were found feeding on young leaves of *Schinus terebinthifolius* Raddi at the Hayselden Ranch, Kau, Hawaii, on September 8, 1954.

CACTOBLASTIS CACTORUM (Berg): Miss Suehiro reported that Mr. William Meinecke had found larvae of this moth doing considerable damage to cactus plants at Waikapuna, Kau, and along the Pali Waiahukini trail, both on the island of Hawaii.

EMESOPSIS NUBILUS Uhler: Mr. Beardsley exhibited a small reduviid of this species (PROC. ZOOL. SOC. LONDON 1894, p. 718) taken in a light trap at Ewa, Oahu, in December, 1954. Later specimens were found which had been collected at Hickam Field, Oahu, on May 10, 1945, by Herms and Russell. It is known from Cuba and St. Vincent and is new to the Territory. Dr. Petr Wygodzinsky of the Instituto de Medicina Regional in Buenos Aires identified the specimens.

FEBRUARY 14, 1955

The 590th meeting was held at the H.S.P.A. Experiment Station on Monday, February 14, at 2:00 P.M., with President Gressitt in the chair.

Members present: Adachi, Beardsley, Bianchi, Boyle, Chilson, Chong, Ford, Fullaway, Gressitt, Hardy, Nakata, Namba, Nishida, Pemberton, D. Rainwater, Rosa, Sherman, Steiner, Tamashiro, Tanada, Van Zwaluwenburg, and Weber.

Visitors: Q. C. Chock and Alan Thistle.

Mr. Q. C. Chock and Mr. H. I. Rainwater were unanimously elected to membership in the Society.

Mr. Chilson's motion to amend Article VII of the constitution so as to impose the payment of dues on women members as well as men was passed.

NOTES AND EXHIBITIONS

INOSTEMMA sp.: Mr. Beardsley exhibited specimens of a platygasterid wasp of this genus which is new to the Territory. They were swept from grasses and weeds at Pohakea Pass, Ewa Plain, and Honolulu, Oahu, on recent dates.

ANOMALA SULCATULA Burmeister: Mr. Van Zwaluwenburg stated that Mr. Clagg, recently returned from a visit to Midway, had observed a number of these beetles on that island. F. C. Hadden had collected one specimen in 1940, but at that time it was not thought to be established.

SCHINUS TEREBINTHIFOLIUS Raddi: Mr. Chilson reported that during November, 1954, a survey of this plant in the Kailua and Honolulu areas had yielded the following insects, none of which had been reported from the plant in the Territory before: *Coccus acuminatus* (Signoret), *Ceroplastes*

rubens Maskell, *Ceroplastes cistudiformis* Townsend and Cockerell, *Toxoptera aurantii* (Boyer de Fonscolombe), *Caecilius analis* Banks, *Amorbia emigratella* Busck, a diaspidid scale, some pseudococcids, and Corrodentia.

Dr. Hardy, just returned from Europe, gave an interesting account of his work and observations in many institutions where he studied collections of Diptera.

MARCH 14, 1955

The 591st meeting was held at the H.S.P.A. Experiment Station on Monday, March 14, at 2:00 P.M., with President Gressitt in the chair.

Members present: Adachi, Balock, Beardsley, Boyle, Carter, Chock, Clagg, Clausen, Fullaway, Gressitt, Hinman, Holway, Joyce, Keiser, Keck, Look, Maehler, Nakata, Namba, Nishida, Pemberton, D. Rainwater, Rosa, Sakimura, Sherman, Steiner, Tamashiro, Tanada, Tuthill, and Van Zwaluwenburg.

Visitors: Mr. and Mrs. J. L. Herring and Alan Thistle.

Alan Thistle was unanimously elected to membership in the Society.

NOTES AND EXHIBITIONS

Dr. Pemberton reported briefly on the 9th Annual Meeting of the Invertebrate Consultants Committee for the Pacific, of the Pacific Science Board, held in Honolulu, March 9-10.

HERMATOBATES sp.: Mr. Herring reported an apparently new species of this gerrid genus collected by him on the north shore of Coconut Island, Oahu, on February 15 and 16. These specimens were taken from salt-water pools in the rocks on the beach. The genus, described by Carpenter in 1891, is represented by 3 species, one from Australia, one from the Philippines, and the other from Djibouti, Africa.

EXITIANUS sp.; **HYPURUS BERTRANDI** Perris: Mr. Fullaway reported for Mr. Davis that these insects were collected at the Kona airport on Feb. 16. The cicadellids were collected on Bermuda grass where they were very abundant. Considerable damage to leaves of *Portulaca* by the weevil was noted. This species (BULL. SOC. ENT. FRANCE 49:100–104, 1944) has been referred to locally as *Ceutorhynchus* sp. The later identification was made by Miss Rose Ella Warner of the U.S.D.A.

CYPHODERUS SQUAMIDIVES Silvestri: Miss Adachi exhibited specimens of this pale, milky white collembolan (BOLL. LAB. PORTICI 12:315, 1917) which were found in large numbers in a nest of the subterranean termite in Honolulu early this month. Dr. John Salmon, of Victoria University College, Wellington, N.Z., identified the species. According to Dr. Salmon, this is the first record for it outside South Africa.

BALCLUTHA HOSPES (Kirkaldy); **B. TIMBERLAKEI** (Osborn): One specimen of each was exhibited by Dr. Namba, the latter one parasitized by

a dryinid wasp. In *B. hospes* the larval sac of the parasite is located on the pleural area of the thorax immediately caudad of the head, while in *B. timberlakei* it is located on the anterior portion of the abdomen.

DESMOMETOPA TARSALIS Loew: Dr. Gressitt reported finding this milichiid fly breeding in material, possibly bone meal with molasses added, set out for cattle to lick, on the northeast lower slope of Mt. Kaala, Oahu, February 15. Puparia also present appear to belong to a larger species.

Dr. Clausen spoke briefly on some of the problems of biological control in California.

APRIL 11, 1955

The 592nd meeting was held at the H.S.P.A. Experiment Station on Monday, April 11, at 2:00 P.M., with President Gressitt in the chair.

Members present: Adachi, Balock, Beardsley, Boyle, Bryan, Carter, Chilson, Chock, Chong, Clagg, Ford, Fullaway, Gressitt, Hardy, Keck, Keiser, Krauss, Look, Nakata, Namba, Nishida, Pemberton, D. Rainwater, Rosa, Sakimura, Steiner, Thistle, Tuthill, and Van Zwaluwenburg.

Visitors: Mr. and Mrs. J. L. Herring and Mr. Soeparbono Sisropranoto.

NOTES AND EXHIBITIONS

ARGIOPE APPENSA Walckenaer: Mr. Van Zwaluwenburg reported the capture of this spider at Pukoo, Molokai, on April 7 by George Otsuka. This is the first record of its occurrence on that island.

KUNZEANA KUNZEI (Gillette): Dr. Namba reported this new cicadellid record for Hawaii, identified by D. A. Young of the U.S. National Museum (PROC. U.S. NAT. MUS. 20:721, 1898). It was taken in a light trap at Ewa, Oahu, December 28, 1954. It is known from Arizona and Texas, where it is reported to feed on legumes but is of no economic significance.

IRIDOMYRMEX HUMILIS Mayr: Mr. Chilson reported collecting this ant attending *Coccus viridis* (Green) on citrus at the Territorial Hospital, Kaneohe, Oahu, on March 8. This is the first record for windward Oahu.

OLIGONYCHUS MANGIFERUS (Rahman and Punjab): Mr. Chilson reported collecting this mite (PROC. IND. ACAD. SCI. (B)11:192, 1940) on *Eugenia jambos* L. leaves at Poamoho, Oahu, on Sept. 27, 1954. It was determined by E. W. Baker. This was recorded here in 1950 as *Paratetranychus insularis* McGregor (see Pritchard and Baker, A REVISION OF THE SPIDER MITE FAMILY TETRANYCHIDAE).

Attention is called to a paper by W. E. China and J. C. M. Carvalho (ANN. MAG. NAT. HIST. (12)5(50):158–166, 1952) in which they synonymize the following Hawaiian mirids:

Cyrtopeltis (*Engytatus*) *luridus* (Gibson) = *Engytatus geniculatus* Reuter
Cyrtopeltis (*Engytatus*) *confusa* Perkins = *Engytatus confusus* (Perkins)
Cyrtopeltis (*Engytatus*) *hawaiiensis* Kirkaldy = *Engytatus hawaiiensis* (Kirkaldy)

TRIGONOTYLUS USINGERI Carvalho: This mirid is described as new (BOL. MUS. NAC. R. DE JAN. ZOOL. 111:1–2, 1952) from native grass in Hawaii. Zimmerman (INSECTS OF HAWAII 3:216, 1948) mentions there being undescribed specimens here that closely resemble the genus *Trigonotylus*.

Noel Krauss, entomologist with the Territorial Board of Agriculture and Forestry, spoke about his recent collecting trip to Fiji, Samoa, the Cook Islands, Tahiti, and Tonga.

MAY 9, 1955

The 593rd meeting was held at the H.S.P.A. Experiment Station on Monday, May 9, at 2:00 P.M., with President Gressitt in the chair.

Members present: Adachi, Balock, Beardsley, Boyle, Chilson, Gressitt, Hardy, Herring, Joyce, Keiser, Look, Maehler, Nakata, Namba, Pemberton, D. Rainwater, Tanada, Thistle, Tuthill, Van Zwaluwenburg, and Weber.

Visitors: Mrs. J. L. Herring and Joseph A. Byrom.

NOTES AND EXHIBITIONS

APHIS FABAE Scopoli: Dr. Hardy received the following information from P. W. Oman of the U.S.D.A. Insect Identification and Parasite Introduction Section: "The aphids from orchids (*Dendrobium*) sent with your letter of April 1 have been identified by Miss Louise M. Russell as *Aphis fabae* Scopoli. She states that this species is recorded from Hawaii by Zimmerman as *Aphis rumicis* L."

EUMENES CAMPANIFORMIS (F.): Mr. Maehler observed this wasp flying in the vicinity of the Kona airport on April 27. This is a new island record.

OMPHISA ANASTOMOSALIS (Guenée): The sweet potato stem borer was noted in *Stictocardia campanulata* (L.) House. A number of the galleries and puparia of this insect were found in stems of this member of the morning glory family which was growing in the Maehler garden.

NYSIUS VINITOR Bergroth: Dr. Pemberton reported that Mrs. B. P. Defibaugh, Postmistress on Canton Island, had sent him some insects collected by her from *Boerhaavia diffusa* L. on April 5. One common insect in the collection was a species of *Nysius*, tentatively determined by Dr. R. L. Usinger of the University of California as *Nysius vinitor* Bergroth. This was later confirmed by Dr. J. W. Evans, Director of the Australian Museum. This is a new record for Canton Island. In Tillyard's INSECTS OF AUSTRALIA and

NEW ZEALAND the statement appears that this species "is abundant in Victoria and New South Wales and does great damage to crops and fruit trees of all kinds."

Mr. Van Zwaluwenburg introduced Mr. Joseph A. Byrom, chief engraver with the Honolulu Star-Bulletin, who spoke to the Society on the preparation of illustrations for publication.

JUNE 13, 1955

The 594th meeting was held at the H.S.P.A. Experiment Station on Monday, June 13, at 2:00 P.M. with Vice-President Van Zwaluwenburg in the chair.

Members present: Adachi, Balock, Beardsley, Boyle, Carter, Clagg, Ford, Haramoto, Hardy, Holway, Joyce, Keck, Look, Maehler, Nakata, Namba, Rosa, Sakimura, Steiner, Suehiro, Tuthill, and Van Zwaluwenburg.

NOTES AND EXHIBITIONS

TOXORHYNCHITES BREVIPALPIS Theobald: Dr. Tuthill reported that he collected a living adult of this mosquito at the University of Hawaii on April 8.

RHYNCOGONUS WELCHII Perkins: Mr. Ford reported that he found the elytra of six specimens of this beetle in Halona Valley, in the Waianae Mountains, Oahu in the latter part of May. It was previously known only from the unique type ("PROCEEDINGS," 8:269,1933).

NYSIUS NIGRISCUTELLATUS Usinger: Dr. Hardy reported that Mr. J. M. Vetter of KGMB told him that operations of the television transmitter on Haleakala were being greatly hampered by tremendous swarms of insects. These were identified by Dr. Hardy as *Nysius nigriscutellatus* Usinger. Mr. Vetter said they occurred in such large numbers that they clogged up the filters used for the air cooling system, and that large numbers entered the building.

CENTRUROIDES GRACILIS (Latreille): Dr. Hardy stated that a large black scorpion collected in a warehouse at Ft. Shafter by Pat Nakagawa has been identified by Dr. Willis J. Gertsch, of the American Museum of Natural History, as this species (HIST. NAT. GEN. CRUST. INS. 7:127, 1804). This scorpion occurs in the U.S. in Florida and southern Texas and is abundant throughout tropical America down into South America. The venom of this species is not particularly dangerous but it is always wise to avoid members of the genus *Centruroides*.

ASCYLTUS sp.: A specimen of jumping spider from Hilo, Hawaii, was given to Dr. Hardy by Dr. Pemberton. It was identified by Dr. Gertsch as *Ascyltus* sp., "very likely *pterygodes* (L.) Koch." Dr. Gertsch says, "It is my

impression that this jumping spider or a relative was once cited as being of considerable economic importance as a control agent. It is said to be a predator on a certain moth in the Fiji Islands that does great damage to the coconut palms." This is a new record for the Territory.

SCOLOTHRIPS PALLIDUS (Beach): Mr. Sakimura gave the following report; "My previous statement on *Scolothrips pallidus* (Beach) ("PROCEEDINGS", 15:357, 1954) is expanded as follows: Examples were collected by me in Manoa, Oahu, on leaves of pigeon pea (*Cajanus indicus* Sprengel), Sept. 25, 1942 (Saki. 1405); Waialae, Oahu, on leaves of carnation (*Dianthus caryophyllus* L.), Sept. 15, 1943 (Saki. 2830–9); and Kunia, Oahu, on leaves of dry-land taro (*Colocasia esculenta* Schott), Nov. 5, 1946 (Saki. 3253 B). *S. pallidus* is not a synonym of *S. sexmaculata* (Pergande) which has never been collected in the Hawaiian Islands. The local specimens previously determined as *S. sexmaculata* have all been redetermined as *S. priesneri* Sakimura."

Dr. Tuthill, Professor of Entomology at the University of Hawaii, gave an informative talk on the University's instructional program in entomology.

JULY 11, 1955

The 595th meeting was held at the H.S.P.A. Experiment Station on Monday, July 11, at 2:00 P.M., with Vice-President Van Zwaluwenburg in the chair.

Members present: Adachi, Barker, Beardsley, Boyle, Bryan, Carter, Chilson, Chock, Chong, Clagg, Ford, Fullaway, Haramoto, Look, Maehler, Nakagawa, Nakata, Nishida, Pemberton, D. Rainwater, Rosa, Steiner, Tamashiro, Tanada, Thistle, Tuthill, Van Zwaluwenburg, and Weber.

Visitors: Dr. Zvi Avidov, Mr. Homer R. Bryan, and Mr. and Mrs. Howard A. Woolford.

NOTES AND EXHIBITIONS

ANTHRAX DISTIGMA Wiedemann: Dr. Joyce mentioned that this recently immigrant bombyliid has apparently become well established. A dozen specimens of this fly were taken at Ft. Armstrong, Oahu, on June 17.

PYGMAEOTHRIPS sp.: Miss Adachi reported that a new species of *Pygmaeothrips* Karny was found feeding on *Fomes connatus* (Weinmann) Gillet, a bracket fungus. The fungus was found on the trunk of an avocado tree in Manoa Valley in May, 1955. Members of this genus are all fungus feeders and have been recorded from Mentawai (a group of islands near Sumatra), Australia, Japan, Formosa, and Guam. This is the first record of this genus in Hawaii.

Mr. Beardsley reported that the following hymenopterous parasites were recently determined by Dr. B. D. Burks of the U.S. National Museum.

HALTICOPTERA AENEA (Walker): This pteromalid (JOUR. ECON. ENT. 37:394–395, 1944) is a parasite of various agromyzid leaf-miners and is widely distributed in Europe and North America. It has been reared locally from undetermined leaf-miners in cabbage, onion and peanut leaves. Specimens are on hand from Oahu, Kauai, and Hawaii. The oldest specimen in the H.S.P.A collection was collected on Kauai in June, 1932, by O. H. Swezey. This has not been previously recorded in our literature.

CYRTOGASTER sp.: Specimens of this pteromalid from Oahu, Kauai, Molokai, Maui, and Hawaii are in the H.S.P.A. collection. The oldest specimen was taken at Kilauea, Hawaii, June, 1917, by O. H. Swezey. There is a previous record of a *Cyrtogaster* sp. nr. *glasgowi* Crawford ("PROCEEDINGS," 13:29, 1947). No host records for this species are known.

HETEROSCHEMA sp.: This is another pteromalid parasite of leaf-mining Diptera and has been reared here from *Melanagromyza virens* (Loew) by Miss Adachi. The species was first collected in the islands in June, 1935, by O. H. Swezey, and is known from Oahu and Maui. There is a reference to a *Heteroschema* sp. ("PROCEEDINGS," 15:19, 1953) taken in the interior of a plane on the ground here, but not known to be established, which may have been this species.

PLEUROTROPIS DETRIMENTOSUS Gahan: This eulophid (PROC. U.S. NAT. MUS. 77(8):9–10, 1931) has been here for many years. One specimen bears the label "number 103 of Timberlake's list." Timberlake ("PROCEEDINGS," 5:418–449, 1924) under this number lists a *Pleurotropis* sp. reared from *Bracon omiodivorum* (Terry) cocoons, Honolulu, April, 1917. It is also known from Hawaii. According to Dr. Burks this is an Oriental species. It is recorded as a parasite of a bethylid, *Perisierola* sp., in India.

TETRASTICHUS sp.: This is another eulophid which has been with us for many years. It is described on page 43 of this issue. It was first collected here from Bermuda grass by Swezey in 1930. Mr. Beardsley has recently reared large numbers from Bermuda grass but has not discovered its host here.

ODONASPIS PENICILLATA Green: This diaspidid scale (ATLAS OF SCALE INSECTS OF NORTH AMERICA, 2, no. 164, 1938) was collected by Mr. Beardsley on bamboo at Foster Gardens, Honolulu, on May 18. It is known from Japan, Formosa, India, and several localities in the U.S., but has not been recorded previously from Hawaii.

LEPIDOSAPHES MASKELLI (Cockerell): Specimens of this scale were collected from needles of an undetermined conifer of the juniper tribe in Manoa Valley, Oahu, on May 9. According to Dr. Morrison, this is the species which Zimmerman (INSECTS OF HAWAII 5:422) refers to as *L. pallida* (Maskell), which he considered doubtfully established here because it had been collected here once in 1894, and then possibly on plants from Japan.

L. maskelli was originally described as a variety of *pallida* but, in a recent work (LES COCHIENILLES DE LA TRIBU DIASPIDINAE, 1954, Pasteur Institute), Balachowsky considers it a valid species.

SCAPHYTOPIUS LORICATUS (Van Duzee): Mr. Beardsley reported that one specimen of this recently immigrant cicadellid was collected in a light trap at Ewa, Oahu, on June 20. This species has been previously collected by Dr. Joyce at Fort Armstrong and Honolulu airport.

NEW RECORDS OF SCOLYTIDAE: Mr. Van Zwaluwenburg reported that Dr. S. L. Wood of Ottawa, Canada, to whom specimens were recently sent for study, called attention to the following new records from the Territory.

Xyleborus semigranosus Blandford, Hilo, Hawaii, May 16, 1950, C. J. Davis, ex monkeypod wood. Known from Sumatra, Seychelles, Mauritius, Ceylon, India, Burma, Java, Samoa, and East Africa (TRANS. ENT. SOC. LONDON 1896, p. 211).

Xyleborus mascarensis Eichhoff (TREUBIA 7:301, 1926), Makaha Valley, Oahu, August, 1954, E. J. Ford, Jr., ex fallen mango branch.

Stephanoderes javanus Eggers, Kanoa, Molokai, Oct. 27, 1930, O. H. Swezey, ex cotton. Known from Java (ENT. BLATT. 5:215, 1909).

Coccotrypes carpophagus (Hornung) (B. P. BISHOP MUS. BULL. 172:148, 1942), Lihue, Kauai, March 11, 1928, O. H. Swezey; Honolulu, Oahu, Jan., 1924–May 11, 1932, O. H. Swezey; Kohala, Hawaii, May 13, 1931; Olaa, Hawaii, May 20, 1931. Hosts: seeds of *Livistona chinensis* (Jacq.) R. Brown, *L. rotundifolia* (Lam.) von Martius; *Dictyosperma album* (Bory) Balf; cabbage palm; *Sabal blackburniana;* royal palm; *Washingtonia filifera* (Linden) Wendland.

? *Ericryphalus trypanoides* Beeson (B. P. BISHOP MUS. BULL. 142:106, 1935), Manoa, Oahu, Jan. 7, 1948–Jan. 24, 1950, O. H. Swezey, ex dead branches and dead bark of breadfruit.

MELANAGROMYZA SPLENDIDA Frick: Dr. Hardy reported that *Melanagromyza splendida* has recently been recorded from Maui; this is a new island record. Celery stalks sent in from Kula in May, 1955, were heavily infested with this stem-miner and extensive damage was reported in all of the celery plantings in this area. It has been known previously from Hawaii and Oahu. The species evidently prefers celery but has also been reared from lettuce, squash, and sweet potatoes. Specimens reared from the celery at Kula were determined by Dr. K. E. Frick.

MELANAGROMYZA VIRENS (Loew): Specimens of this stem miner were exhibited which had been reared from zinnia at Aina Haina, Oahu, May, 1955, where they were doing extensive damage to these flowers. It has previously been reported in our minutes as *Agromyza virens* Loew, reared from several different hosts. This species is widespread in North America and has

reached pest status at least once in southern California, according to Dr. Frick. He intimates that the name *virens* may not be correctly used.

SEPSIS BIFLEXUOSA Strobl: This fly is recorded from the island of Hawaii for the first time from specimens collected in the Kohala and Kona districts by C. J. Davis. He has also taken this at Waihee, Maui, June, 1952, and Kokee, Kauai, July, 1952. It has been previously known in Hawaii only from Oahu.

Dr. Carter, Dr. Steiner, and Dr. Tanada told of some of the interesting papers given at the Pacific Branch meeting of the Entomological Society of America held recently at Riverside, California.

Dr. Avidov, entomologist of the Israel Ministry of Agriculture, our guest speaker, gave a most informative talk on the ecology of the olive fly.

JULY 19, 1955

A special meeting was held at the H.S.P.A. Experiment Station on Tuesday, July 19, at 3:15 P.M., with Vice-President Van Zwaluwenburg in the chair.

Dr. Pemberton introduced our guest speaker, Dr. A. J. Nicholson, Chief of the Department of Entomology, Commonwealth Scientific and Industrial Research Organization of Australia. Dr. Nicholson presented an excellent discussion of his ecological studies of the past seven or eight years.

AUGUST 8, 1955

The 596th meeting was held at the H.S.P.A. Experiment Station on Monday, August 8, at 2:00 P.M., with Vice-President Van Zwaluwenburg in the chair.

Members present: Adachi, Balock, Beardsley, Bess, Boyle, Carter, Chock, Chong, Clagg, Fullaway, Haramoto, Hardy, Hinman, Joyce, Kamasaki, Keck, Keiser, Maehler, Nakata, Namba, Pemberton, D. Rainwater, Rosa, Sakimura, Sherman, Steiner, Tamashiro, Tanada, Thistle, Tuthill, and Van Zwaluwenburg.

Visitors: Mr. and Mrs. H. A. Woolford and Mr. V. Staten.

Mr. Homer Bryan was unanimously elected to membership in the Society.

NOTES AND EXHIBITIONS

Mr. Beardsley gave the following notes:

TRIONYMUS ROSTELLUM Lobdell: This mealybug (ANN. ENT. SOC. AMER. 23:219–220, 1930) was first discovered in the Territory about four months ago on Meier grass (*Zoisia* sp.) which was being held in quarantine at the Board of Agriculture and Forestry in Honolulu. Specimens collected

there were determined as this species by Dr. Harold Morrison. Since that time it has been found on Bermuda grass at Waipio, and on the H.S.P.A. Experiment Station grounds. Material collected near Honolulu airport in Sept., 1954, proved to be this species. This mealybug has been collected from several kinds of grasses in California and the Gulf States. It has probably been present here for some time.

BRUCHOPHAGUS GIBBUS (Boheman): This alfalfa seed chalcid was known previously in the Territory from a single specimen collected on Molokai in 1929 by O. H. Swezey. It was reared in numbers from alfalfa seed collected at Waipio, Oahu, July 10, by J. W. Beardsley.

HABROCYTUS MEDICAGINIS Gahan: Many specimens of this pteromalid wasp (JOUR. AGR. RES. 7:147–153, 1916), a primary parasite of *Bruchophagus gibbus*, also emerged from the above mentioned alfalfa seed. The number of these parasites exceeded the number of *B. gibbus* emerging by more than two to one. This wasp has not been previously reported from the Territory.

CHARITOPODINUS SWEZEYI (Crawford): A few specimens of this wingless eupelmid also emerged from the alfalfa seed material. This is probably a primary or secondary parasite of the seed chalcid. It has been bred from a eurytomid, *Harmolita swezeyi* Phillips and Poos, and from several hymenopterous parasites in the Territory.

CERATOXYS LATIUSCULA (Loew): This otitid fly (MON. N. A. DIPT. 3:130, 1873) has apparently missed being recorded in our literature. Dr. Hardy has found over a dozen specimens in local collections, the earliest record being three specimens taken in a rice field at Pearl City, Oahu, February 27, 1928, by O. H. Swezey. More recently it has been taken at Hickam Field and Honolulu, Oahu, and at Mana and Halemanu Swamp, Kokee, Kauai. The species is common in the western United States and Mexico but has not been reported from the Pacific. One specimen was found dead in an airplane, origin unknown, at Hickam Field, July 13, 1955. The plane was thought to have come from the west.

ARAECERUS LEVIPENNIS Jordan: Dr. Hardy reported he had received a letter from Dr. H. E. Karl Jordan reporting that he has been able to place the *Araecerus* which infests the beans of koa haole (*Leucaena glauca* (L.)) in Hawaii ("PROCEEDINGS," 15:376, 381, 1954). He says that this agrees with *A. levipennis* Jordan (NOV. ZOOL. TRING 31:248, 1924), described from Manila and Cochin China.

Dr. Boyle reported on mites as follows:

A shipment of dormant bamboo from Hong Kong that arrived in Honolulu February 25, 1954, was placed in the H.S.P.A. quarantine house. When new growth appeared the plants were discovered to be infested with tetranychid mites. Specimens of these mites were sent to Dr. E. W. Baker of the

U.S. National Museum, who identified them as *Oligonychus pratensis* (Banks) and a second species of *Oligonychus* (= *Paratetranychus*). Prior to this, *pratensis* had been known only from western North America where it is a serious pest on range grasses (WASHINGTON AGR. EXP. STA. TECH. BULL. 17, 1955). As this mite is a polyphagous feeder within the family Gramineae, but not known on other plant hosts, the thought occurred that it might prove to be a possible pest of sugar cane if it became established in Hawaii. An attempt was therefore made to determine whether *pratensis* occurs here and could have infested the quarantined bamboo subsequent to its arrival in Honolulu. Accordingly, mites were again collected from the bamboo and from sugar cane outside the quarantine house. These, along with a tetranychid from bamboo in Nuuanu Valley, were sent to Dr. A. E. Pritchard of the University of California who identified the mite from quarantined bamboo and from sugar cane near the quarantine house as *Oligonychus indicus* (Hirst). This is undoubtedly the same mite that Baker identified as *Oligonychus* sp. The mite from bamboo in Nuuanu Valley was identified as *Schizotetranychus celarius* (Banks). These are new records for the Territory.

Several lots of mites collected on sugar cane more recently by Messrs. Van Zwaluwenburg and Beardsley, including one from a quarantine house at Mapulehu, Molokai, all appear to Mr. Haramoto and myself to be *O. indicus*. Apparently a single species of tetranychid is known to occur on sugar cane in Hawaii. This was determined by Dr. Swezey in 1923 (HAWAIIAN PLANTER'S RECORD, vol. 27, pp. 4–7) as *Tetranychus exsiccator* Zehntner, a mite occurring on sugar cane in the Dutch East Indies. Swezey's determination was probably made largely on a basis of host and he presumably had before him specimens of *O. indicus*. At the present time, therefore, *O. pratensis* is not known to occur in Hawaii.

PARASITE SHIPMENTS TO PACIFIC ISLANDS: Mr. Van Zwaluwenburg stated that the Experiment Station, H.S.P.A., has recently supplied the following beneficial insects for release in other parts of the Pacific:

15,000 *Telenomus nawai* Ashmead to R. P. Owen, for release on Ponape in the Carolines; May, 1955.

15,000 *T. nawai* to G. D. Peterson, Jr., for Tutuila, American Samoa; July, 1955.

About 300 puparia of *Eucelatoria armigera* (Coquillet) and *Frontina archippivora* (Williston) to Mr. Peterson, for Tutuila, July, 1955.

Dr. Bess showed an excellent series of Kodachrome slides and told some of the interesting phases of his recent work in Ceylon.

SEPTEMBER 12, 1955

The 597th meeting was held at the H.S.P.A. Experiment Station on Monday, September 12, at 2:00 P.M., with Vice-President Van Zwaluwenburg in the chair.

Members present: Adachi, Balock, Barker, Beardsley, Bianchi, Boyle, E. Bryan, H. Bryan, Carter, Chilson, Chock, Chong, Christenson, Clagg, Fullaway, Haramoto, Hardy, Joyce, Kamasaki, Keck, Keiser, Look, Maehler, Nakata, Namba, Pemberton, Rosa, Sakimura, M. Sherman, Steiner, Suehiro, Tanada, Thistle, Tuthill, and Van Zwaluwenburg.

Visitors: J. E. Alicata, F. G. Krauss, and Dr. Ariyant Manjikul, an entomologist from Thailand.

Mr. H. A. Woolford was unanimously elected to membership in the Society.

NOTES AND EXHIBITIONS

BRUCHOPHAGUS GIBBUS (Boheman): Mr. Chilson reported that specimens of this eurytomid (U.S.D.A. FARMERS' BULL. 1642:1–14, 1931) were bred from alfalfa seed collected on Ford Island, Oahu, by G. Pearsall and L. Chilson on March 17, 1954, and reported as *Megastigmus* sp. ("PROCEEDINGS," 15(3):378, 1955). The error was caused by the specimens having been identified locally by comparison with a specimen collected by Mr. Fullaway in 1922 and determined as this ("PROCEEDINGS," 5(2):185, 1923). These same specimens have recently been identified by C. F. W. Muesebeck as *B. gibbus*. *Habrocytus medicaginis* Gahan was also identified by Muesebeck from this material.

HYPURUS BERTRANDI Perris: Mr. Van Zwaluwenburg and Mr. Beardsley found the larvae of this weevil mining the leaves of *Portulaca* at several localities on Kauai in the latter part of August. This is a new island record.

EUMENES LATREILLEI PETIOLARIS Schulz: Dr. Pemberton stated that Mrs. B. P. Defibaugh had sent him a specimen of this eumenid wasp which she had collected on Canton Island on September 6, 1955. This is the first record of its appearance on that island.

OESTRUS OVIS L.: Dr. Hardy reported that C. J. Davis wrote to him that he had received a report from Dr. G. N. Stemmermann that a large fly attacked several men at Puako, Hawaii, and deposited maggots in their eyes, causing injury to the conjunctiva. Later Dr. S. S. Koide brought one of the preserved larvae to Dr. Hardy. It was a first instar larva of *Oestrus ovis*. The doctor said the flies larviposited in the eyes and nostrils of three men as they were eating lunch. A number of larvae were removed and the specimen brought to him was recovered from the nostrils thirteen days after the attack. This is at least the second time this has been reported in Hawaii. Dr. Robert

B. Faus removed larvae from the eye of a patient in Honolulu, the case being reported by Dr. W. B. Herms (JOUR. PARASIT. 12(1):54–56, 1925).

MICROCTONUS sp.: Mr. Fullaway exhibited a braconid wasp of this genus which is new to the Territory. It was found in blooms of kiawe collected at Moanalua, Oahu, by Miss Mabel Chong in September, 1955.

COPTOTERMES FORMOSANUS Shiraki: Dr. Namba reported that Mr. William Takabayashi, a former pest control operator familiar with the habits of this termite, had observed numbers crawling over an exposed area without any form of protective covering for about two weeks early in August, 1955. This occurred in a nose hangar at Hickam Field, Oahu, with the spot under observation exposed to the sun in the afternoon. Shortly after, Dr. Namba observed lesser numbers coming from a crack between the concrete floor and sill, crawling about nine inches up the sill into a crack between it and a wooden supporting base. There was no sign of a runway.

OCTOBER 10, 1955

The 598th meeting was held at the H.S.P.A. Experiment Station on Monday, October 10, at 2:00 P.M., with Vice-President Van Zwaluwenburg in the chair.

Members present: Adachi, Balock, Barker, Beardsley, Bess, Bianchi, Boyle, Carter, Chong, Clagg, Dresner, Ford, Fullaway, Hinman, Holway, Kamasaki, Keck, Keiser, Look, Maehler, Nishida, Pemberton, D. Rainwater, Rosa, Sakimura, Sherman, Tanada, Thistle, Tuthill, and Van Zwaluwenburg.

Visitors: Alden D. Hinckley, Jonathan Kajiwara, Arthur Miyashita, Alice E. Pettingill and Carl M. Yoshimoto.

The death of Dr. R. C. L. Perkins on September 30, 1955, was announced, and the Secretary read a biographical sketch of Dr. Perkins by Mr. Fullaway.

The Secretary read an announcement of the death of Prof. Remo Grandori, of Milan, Italy, on August 6, 1955.

NOTES AND EXHIBITIONS

POLLENIA RUDIS (F.): Dr. Joyce exhibited a specimen of this well-known calliphorid, the cluster fly (INSECTS OF WESTERN NORTH AMERICA, p. 587), captured at a window at Fort Armstrong, Honolulu, on September 29. The species is parasitic on earthworms and is known from North America, Europe, North Africa, India and China. The larva has been doubtfully reported causing enteric myiasis in man. This is the first record of the genus in the Territory.

EXITIANUS EXITIOSUS (Uhler): Mr. Beardsley stated that Dr. D. A. Young of the U. S. National Museum had given him this name (AMER.

ENT. 3:72–73, 1880) for the species found on Oahu in 1947. It has also been found on Hawaii and at times is abundant on Bermuda grass.

PLOCHIONUS TIMIDUS Haldeman: Mr. Beardsley stated that a specimen of this beetle had been captured at light in Aina Haina, Oahu, on September 30. The only previous record in the Territory is that of O. H. Swezey, from Maui ("PROCEEDINGS," 5:342, 1924).

Dr. Hardy presented the following notes:

CRICOTOPUS BICINCTUS (Meigen): This chironomid, new to the Territory, was discovered by Mr. Beardsley from light trap collections at Waipio, Oahu, on September 8, 1955. It has since been found in light trap catches at Ewa and by sweeping grass near Kipapa Gulch, Oahu. The species (SYST. BESCHR. 1:41, 1818) is widespread over Europe and has been recorded from eastern United States and Japan. Its habits are unknown, but other members of the genus mine the leaves of aquatic plants.

CLUNIO TSUSHIMENSIS Tokunaga: A series of this chironomid (PHIL. JOUR. SCI. 51:92, 1933) was collected by Miss Adachi in August, 1955, at Kuliouou Beach Park, Oahu. Adults were found running about on the sand at the water's edge. They were also collected in a light trap at the Honolulu airport by C. R. Joyce on August 11, 1955. This is the first record for the species outside Japan.

CHIRONOMUS ESAKII Tokunaga: This is the chironomid recorded in our "PROCEEDINGS" as the "plain legged" *Chironomus* by Williams (12:228, 1945) and Wirth (13:9, 491, 1949). *C. insolens* Johannsen (INSECTS OF GUAM II:192, 1946) is a synonym of *esakii*. At my request Dr. Tokunaga compared specimens from Guam with his type of *esakii* (PHIL. JOUR. SCI. 71(2):221, 1940) and confirmed the synonymy of *insolens*. The species has been known previously only from Saipan and Guam. It is common in the lowlands in Hawaii and probably occurs on all the main islands. I have seen specimens from Oahu, Hawaii, and Molokai.

ANOPHELES spp.: Dr. Holway presented the following observations made on Guam between July 20 and August 18, 1955:

An *Anopheles*, presumably *subpictus indefinitus* Ludlow, was taken in a number of locations found negative in 1951 (U.S.A.F. MED. JOUR. 3(9):1287–1295, 1952). Larvae or adults were found near Apra Harbor, Nimitz Hill, Naval Station, Piti, Asan, Agat Bay, Coontz Junction, and N.A.S. Agana. Fifty-seven adults were taken in light traps during 22 trap nights. None was taken biting humans. There is still no evidence of autochtonous malaria on Guam.

The most common mosquitoes in the jungle are *Aedes pandani* Stone and *Aedes albopictus* Skuse. However, they are not the most important pests in housing areas except where *Pandanus* growth is common. In such areas *A. pandani* is a severe pest in the open at night if there is no wind. The major

pests are the night-biting *Aedes vexans nocturnus* Theobald, *Culex quinquefasciatus* Say, and *Culex annulirostris* Bohart and Ingram. *C. quinquefasciatus* is common in domestic containers in the villages. These three species were taken frequently in light traps but *A. pandani* and *A. albopictus* were rarely taken even where bite counts were high. *Aedes aegypti* (L.) was not found. It was common on Guam in 1945 but has not been recorded since 1948.

OMIODES ACCEPTA (Butler): Mr. Bianchi stated that between September 20 and 28 he had found many caterpillars of the sugar cane leaf-roller parasitized by *Meteorus laphygmae* Viereck in the upper cane fields of the Hamakua coast, Hawaii. This constitutes a new host record for *Meteorus*, which was introduced in 1942–43 as a parasite of armyworms.

CACTOBLASTIS CACTORUM (Berg): Mr. Bianchi called attention to the efficient work of this caterpillar on cactus in the Diamond Head region. He stated that in his opinion the plant will disappear from the region if the present rate of destruction continues for another year or two.

Mr. Edgar Dresner, member of the Society presently residing in Java, gave a very interesting account of his work there and of the general entomological conditions of the country.

NOVEMBER 14, 1955

The 599th meeting was held at the H.S.P.A. Experiment Station on Monday, November 14, at 2:00 P.M., with President Gressitt in the chair.

Members present: Adachi, Balock, Barker, Beardsley, Bess, Bianchi, Boyle, Chock, Chong, Christenson, Ford, Fullaway, Gressitt, Hardy, Hinman, Joyce, Look, Nakata, Nishida, Pemberton, D. Rainwater, I. Rainwater, Rosa, Sakimura, Sherman, Tanada, Thistle, Tuthill, Van Zwaluwenburg, Weber, and Woolford.

Visitors: Dr. Paul Surany, Donald Awai, Carl M. Yoshimoto, Jonathan Kajiwara, Alden D. Hinckley, and Grace Nagamine.

Dr. Yoshimoto, Mr. Hinckley, and Mr. Kajiwara were unanimously elected to membership in the Society.

NOTES AND EXHIBITIONS

CRICOTOPUS BICINCTUS (Meigen): Miss Adachi reported this midge coming to light in Manoa Valley, Oahu.

DERMESTIDS: Dr. Bess exhibited dermestid-infested wood from a house which had been treated for termites a year ago. Dr. Hardy stated this was a common occurrence and mentioned that the phorid *Megaselia scalaris* (Loew) was also commonly found in old, fumigated termite burrows.

KUNZEANA KUNZEI (Gillette): Mr. Beardsley reported nymphs and adults of this cicadellid feeding on the leaves of klu at Ewa, Oahu, on October

26. This is the first record of a host plant for this insect here, all previous collections having been from lights. The leafhoppers were found on the under surface of the leaves and their feeding apparently caused tiny chlorotic spots.

DETTOPSOMYIA NIGROVITTATA (Malloch): Dr. Hardy reported that this drosphilid fly (PROC. LINN. SOC. N.S.W. 49:352, 1924) is evidently widespread over the islands and has been taken at several localities on Maui, Oahu, and Molokai. The earliest collection date is June 7, 1950, on a specimen from Manoa Valley, Oahu. This is a new record for the Territory.

FRANKLINOTHRIPS VESPIFORMIS (Crawford): Mr. Bianchi stated that specimens of this predatory thrips from the mainland (JOUR. WASH. ACAD. SCI. 42(1):16, 1952) were collected by Mr. Beardsley on corn plants at Ewa, Oahu, early this month. This is the first record of the species from the Territory.

KURTOMATHRIPS MORRILLI Moulton: Mr. Bianchi stated that this is the name of the thrips (BULL. BROOKLYN ENT. SOC. 22:188, 1927) reported by him on *Pluchea odorata* (L.) Cassini at the October, 1954, meeting. It is a species reported originally from cotton in Arizona.

Mr. Bianchi gave an account of his recent explorations in Portugal and the Macaronese Islands for enemies of *Myrica faya* Aitken.

DECEMBER 12, 1955

The 600th meeting was held at the H.S.P.A. Experiment Station on Monday, December 12, at 2:00 P.M., with President Gressitt in the chair.

Members present: Adachi, Balock, Barker, Beardsley, Bess, Bianchi, Boyle, Carter, Chong, Christenson, Ford, Fullaway, Hardy, Hinckley, Kajiwara, Keiser, Nakata, Nishida, Pemberton, D. Rainwater, Sakimura, M. Sherman, Tanada, Thistle, Tuthill, Van Zwaluwenburg, and Woolford.

Visitors: Donald Awai and Jules Fine.

The following officers were elected for 1956:

President.....Y. Tanada
Vice-President.....L. D. Christenson
Secretary-Treasurer.....F. A. Bianchi
Member of Executive Committee.....C. E. Pemberton

Mr. Christenson read an obituary of Frank G. Hinman, who was killed in a hiking accident on November 27.

After discussion and modification the revised constitution and bylaws were unanimously adopted.

Notes and Exhibitions

Achrysopophagus rex Girault: Mr. Fullaway stated he had reared this encyrtid (Proc. U.S. Nat. Mus. 58:188, 1920) from *Pseudococcus citri* (Risso) on *Asystasia coromandeliana* Nees at Lanikai, Oahu, in November. This is the first record of the species in the Territory.

Scymnus roepkei Fluiter: Mr. Beardsley stated that Dr. Chapin had given him this name (Arch. Koffiecultur Ned.-Ind. 5(1):49–56, 1938) for the coccinellid which has been referred to as *Scymnus* near *bipunctatus* in our literature. It was described from Java and is widely distributed in Micronesia.

Euchalcidia sp. near **philippinensis** Masi: Mr. Beardsley stated that Dr. Burks had identified this chalcid, first collected in the Territory in Honolulu, Oahu, during November, 1954.

The following notes were presented for Messrs. C. W. Sabrosky and W. W. Wirth, Ent. Res. Branch, Agr. Res. Serv.:

Nannodastia horni Hendel: Several specimens of this ephydrid fly, described from Formosa (Konowia 9:68–70, 1930), were collected by Mr. Wirth on windows of the Officers' Club at Kailua, Oahu, on June 1, 1946. The genus is new to Hawaii. Recognition of the species is simplified by the unusual wing venation, figured by Hendel.

Azorastia Frey: This genus (Soc. Scient. Fennica, Commentationes Biologicae 8(10):72, 1945), proposed in the family Asteiidae for *A. minutissima* Frey from the Azores, belongs in the tribe Atissini of the Ephydridae. "We examined a paratype kindly loaned by Professor Frey, and the only difference from *Nannodastia* appears to be the presence of crossveins on the wing. This character is not generic elsewhere in the Ephydridae (e.g., *Zeros*), and in the absence of supporting characters it may not be distinctive in the present case. However, with present limited material, we leave the genera distinct."

The following notes were presented for Mr. E. C. Zimmerman, of the British Museum (Natural History):

Acarina new to Hawaii: In 1945, Dr. E. W. Baker of the U.S. National Museum determined the following mites which appear to be new to the Hawaiian fauna: *Gabucinia* sp., from pigeon, March 5, 1945, Oahu; *Myobia musculi* (Schrank), from mouse, March 7, 1945, Oahu; *Glycyphagus domesticus* (Degeer), the house or furniture mite, March 7, 1945, Oahu. The house mite is widespread and may be found feeding upon fungi growing on many items, including foodstuffs such as cheese, sugar, flour, cereals, etc. A discussion of the mite, with illustrations, may be found in A. M. Hughes' The Mites Associated with Stored Food Products, pp. 59–61, figs. 75–77, 1948; H. M. Stationery Office, London. Pritchard and Baker, in their The False Spider Mites of California, Univ. California

Pubs. Ent. 9(1):38, figs. 38, 39, 1952, reported *Brevipalpus phoenicis* (Geijskes) from papaya, *Passiflora*, and puncture vine from Oahu.

PARTHENOTHRIPS DRACAENAE (Heeger): This species was intercepted at Seattle, Washington, on *Anthurium* foliage imported from Hawaii on August 8, 1950. This record of the species in Hawaii antedates that of Carter, who discovered it at Wahiawa, Oahu, in 1952 ("PROCEEDINGS," 15:7, 1953).

HELIOTHRIPS HAEMORRHOIDALIS (Bouché); NIPAECOCCUS NIPAE (Maskell): These species were found by Dr. Pemberton and me on *Broussaisia* on the road to Kulani, Hawaii, on July 19, 1952, and constitute a new host record.

CHRYSOBOTHRIS INDICA Castlenau and Gory: This is the species of Buprestidae (HIST. NAT. ICON. INS. COL. 2:12, 1853) first reported in Hawaii at the June, 1946, meeting. It is widespread from India to Indonesia, being reported to bore in *Acacia*, *Anogeissus*, *Mimusops*, and *Myristica*.

LAGOCHEIRUS OBSOLETUS Thomson: Some years ago, Mr. L. S. Dillon requested the loan of material of this cerambycid from Hawaii, and I sent him a female from Honolulu for examination. He also acquired two specimens collected by Davis at Kona, Hawaii. The species is extremely variable in color, size, and pattern. Mr. E. A. Duffy, who has charge of the Cerambycidae at the British Museum, and I have studied the problem carefully, and I have compared Hawaiian material with the holotype in the Natural History Museum in Paris. Dillon's *zimmermani* (ENT. NEWS 63(8):207, 1952) falls into synonymy.

TACHYPOMPILUS ANALIS (F.): This immigrant wasp was abundant at Mahaulepu, Kauai, on July 30, 1952, this being an earlier record for the island than that presented at the August, 1954, meeting.

PELOMYIA CORONATA (Loew): The following note was presented for M. R. Wheeler, of the University of Texas: Specimens of this tethinid fly (AMER. MUS. NOV. 76:7, 1923) were collected by him between Lanikai and Nuuanu Pali, Oahu, on Sept. 9–10, 1955. Other specimens from Pukoo, Molokai, Dec., 1953–Jan., 1954, S. Shimabukuro, are in the University of Hawaii collection. The genus is new to the Territory. This species is widespread in the United States and is also known from Alaska, Mexico, and Peru (JOUR. N.Y. ENT. SOC. 59:187–212, 1951).

Dr. Gressitt turned over the chair to Dr. Tanada, incoming president, and presented a lecture, illustrated with colored slides, on his recent trip to New Guinea.

Frank Gerald Hinman

1907–1955

(Presented at the meeting of December 12, 1955)

While hiking with the Oahu Trail and Mountain Club on November 27, 1955, Frank G. Hinman, Research Entomologist at the U.S. Department of Agriculture's Fruit Fly Laboratory in Honolulu, fell 150 feet to his death. A portion of the trail along a ridge near the Crouching Lion at Kahana Bay gave way and there was nothing he could reach to save himself.

Mr. Hinman was born in Bozeman, Montana, December 9, 1907. After graduating from Montana State College in 1929 he obtained his Master's degree at Washington State College in 1930. Mr. Hinman entered the federal entomological service at Wenatchee, Washington, in 1931. Except for a period of active duty with the Army in World War II, Mr. Hinman was continuously engaged in pea weevil investigations from 1932 to 1948 with headquarters at Corvallis, Oregon, until 1934 and then at Moscow, Idaho. He was transferred to the U.S. Department of Agriculture Fruit Fly Laboratory in Honolulu in 1948, his affiliation at the time of his death.

Mr. Hinman served overseas with the 7th Field Hospital from 1942 to 1945 as a dental technician. This field hospital was awarded a unit citation for meritorious service in Normandy, northern France, Rhineland, and central Europe.

At the time of his death Mr. Hinman was engaged in fruit fly commodity treatment studies, paying special attention to fumigant screening and application of fumigant materials to fruit fly-infested commodities in aqueous dips. Last summer he visited laboratories in Europe, Canada, and eastern United States, where ionizing irradiation is being investigated as a food sterilization method. Mr. Hinman made important contributions to our knowledge of control of the pea weevil, the oriental fruit fly, and of treatments for destroying fruit flies in fresh fruits and vegetables. He is the author or collaborated in authorship of a number of articles on these subjects which appeared from 1932 to 1953.

He is survived by his mother, Mrs. Minnie C. Guyton, of Honolulu, and two brothers in Montana.

Although quiet and unassuming, Frank Hinman made many close friends in his profession and outside of it. Capable, cooperative, and conscientious in his research, he was also a good companion and loyal friend.

A New Dictyophorodelphax from Kauai (Homoptera: Delphacidae)

JOHN W. BEARDSLEY, JR.

H.S.P.A. EXPERIMENT STATION
HONOLULU, HAWAII

(*Presented at the meeting of November 14, 1955*)

The unusual endemic delphacid genus *Dictyophorodelphax* Swezey contains four previously described species; two from Oahu, and one each from Maui and Lanai. The discovery of a fifth species, described below, on the island of Kauai, suggests strongly that additional species probably await discovery elsewhere in the Hawaiian Islands.

Dictyophorodelphax zwaluwenburgi, new species

Female. Length, 5.5 mm.; cephalic horn from top of eye to tip, 2.4 mm. long, laterally compressed distad, apical third bent only slightly ventrad so that when viewed from side a forward prolongation of the straight portion of the ventral margin intersects the dorsal lateral carina at about its apex, ventral carinae becoming evanescent about half way to tip, apparently joining dorsal lateral carinae slightly less than three-fourths distance from bases of these, sparsely clothed with short fine hair; tegmina, 1.7 mm. long, 0.7 mm. wide, covering slightly more than half of abdomen.

Color predominately testaceous with dark markings. Cephalic horn brownish with fine light flecking, laterally becoming darker along anterior part of ventral margin. Frons testaceous, becoming slightly darker anteriorly, fine fuscous lines along edges of carinae. Clypeus with a median longitudinal pale streak and two broad lateral convergent fusco-testaceous streaks which become narrower and darker apically, and extend onto base of labrum. Scapes of antennae with a dorsal longitudinal fuscous stripe and a ventral fuscous spot.

Legs with longitudinal fuscous stripes on femora and tibiae, connected in a few places by irregular dorsal transverse fuscous bands, dark dorsal spot at apex of first segment of hind tarsi, apex of last segment of all tarsi dark. Tegmina with a narrow black mark along apical third of commissural margin of clavus, shorter but wider black mark near apex of costal margin, smaller less distinct black marks along apical margin between apical veins, small apparently non-setigerous black granules along veins.

Abdomen mottled with testaceous and darker areas, becoming flavous in a narrow stripe along median dorsal line; tip of ovipositor tinged with orange, anal style orange.

Male. Unknown.

Described from a single female collected near Kokee, Kauai, August 28, 1955, at an altitude of approximately 3,000 feet, by J. W. Beardsley. The specimen was swept from low vegetation, consisting primarily of *Euphorbia* sp. and *Styphelia tameiameiae* (Cham.) F. v. Mueller. All other known species of *Dictyophorodelphax* feed upon native species of *Euphorbia*, and it seems probable that *D. zwaluwenburgi* is also attached to plants of this genus. The type is deposited in the collection of the Experiment Station of the Hawaiian Sugar Planters' Association. The species is named for Mr. R. H. Van Zwaluwenburg of the Experiment Station, H.S.P.A.

Dictyophorodelphax zwaluwenburgi is similar in general appearance to both *D. praedicta* Bridwell from Maui and *D. usingeri* Swezey from Lanai. The relative length of the cephalic horn is greater than that of *usingeri*, but is slightly less than that of *praedicta*. The apical portion of the horn of *zwaluwenburgi* is more bluntly rounded and less strongly bent downward than in either of these species (fig. 1). The tegmina of the new species are relatively longer and narrower than those of either *praedicta* or *usingeri*. In outline they more nearly resemble those of *D. swezeyi* Bridwell from Oahu, although not as large. The dark granules along the veins lack the conspicuous setae of *usingeri* and *swezeyi*. The general coloration of the type of *zwaluwenburgi* is somewhat darker than any specimens of the other four species of the genus which were examined, although these may have faded somewhat with age. The coloration of the clypeus of the type is distinctly lighter than in any other specimens of the genus seen.

The following modification of the key to the species of *Dictyophorodelphax* which is presented on page 169, Vol. 4, of INSECTS OF HAWAII, by E. C. Zimmerman, will facilitate the identification of the species described here. To use, refer the second half of Zimmerman's couplet 2 to 2A, and insert 2A between couplets 2 and 3.

2A. Tip of cephalic horn bent only slightly ventrad, a forward prolongation of the straight portion of the ventral margin intersects the dorsal lateral carina about at its apex; tegmina about 2½ times as long as wide; Kauai..... **zwaluwenburgi** Beardsley

Tip of cephalic horn bent more strongly ventrad, a forward prolongation of the straight portion of the ventral margin intersects the dorsal lateral carina well before its apex; tegmina less than twice as long as wide.....3

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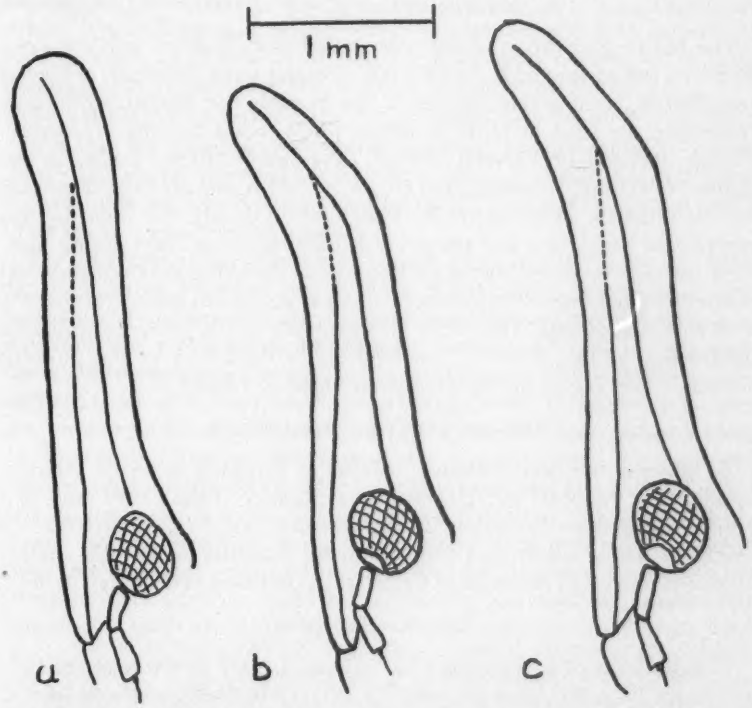

Fig. 1. *Dictyophorodelphax* spp., lateral view of cephalic horns: *a*, *D. zwaluwenburgi*, n. sp., holotype female; *b*, *D. usingeri* Swezey, female; *c*, *D. praedicta* Bridwell, female.

Ecological Notes on Lamprophorus tenebrosus (Walker) (Coleoptera: Lampyridae), an Enemy of the Giant African Snail[1]

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(*Presented at the meeting of December 12, 1955*)

The Indian glow-worm, *Lamprophorus tenebrosus* (Walker), is a voracious feeder on the African or Kalutara Snail, *Achatina fulica* Bowdich, in Ceylon and there is considerable interest in the possible use of this predator in combating the snail in other countries where it has become established. During 1954 and 1955 several hundred larvae were collected in Ceylon and shipped to Hawaii, Indonesia, and Guam, and arrangements have been made for the shipment of larvae to the Philippines. Considerable difficulty was experienced during the first attempts to collect larvae at night during June, 1954, but after investigating the habits of the larvae sufficient information was obtained so that eventually hundreds of larvae were taken during the daytime with comparative ease. This paper presents some of the pertinent ecological information known about *L. tenebrosus* and a discussion of the probable economic importance of this predacious beetle in Ceylon.

DISTRIBUTION OF L. TENEBROSUS

L. tenebrosus has been collected in India at Balugaon in Orissa, Madras, Pondicherry, Madura, and Dharwar near Bombay (Paiva, 1919) and in a number of localities in Ceylon. The information available indicates that the species is better known and probably more abundant in the hill country around Kandy and Peradeniya in Ceylon than elsewhere in Ceylon or in India.

GENERAL BIOLOGY

Female adults of *L. tenebrosus* are larviform, creamy yellow in appearance, and about 2½ inches in length, while the winged brownish males are approximately 1 inch in length. Adult males were collected at night in our residence in Kandy each month from June, 1954, through March, 1955, but only one female was observed during the same period. It was found on September 4,

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[2] The cooperation of Dr. H. E. Fernando, entomologist of the Ceylon Department of Agriculture, and his staff in collecting and packing *Lamprophorus* for shipment is gratefully acknowledged.

1954, in a chamber in the soil with about 40 eggs. Green (1912) and Gravely (1915) reported seeing females in the Kandy-Peradeniya area during the rainy season, around November to January, but it is likely that females also occur during the greater part of the year. Both Green and Gravely stated that virgin females attract the males to them at night by emitting light. Furthermore, Green observed males attracted to females of other species, including *Dioptoma* sp. On the night of July 26, 1954, a male *L. tenebrosus* and a larviform female of a smaller unidentified species were taken together, both emitting light at the time, but they were probably not *in coitu*.

After mating the female excavates a chamber in the soil in which she lays her eggs and broods over them until they hatch and she dies (Hutson and Austin, 1924). From 12 insectary-reared females they obtained between 30 and 101 eggs, an average of 66 eggs per female. They concluded that the normal length of life of the female was 2 to 3 months and that of the male about 2 weeks. The adults appeared to ingest water but did not feed on snails.

The eggs are spherical, yellowish to brownish in appearance, and about ⅛ inch in diameter when laid but increase to about 1/6 inch in diameter before hatching (Hutson and Austin). These authors found the incubation period to be about 7 weeks in the insectary.

The larvae during the earlier instars are shining black in appearance, while the larger larvae, although also basically shining black, have conspicuous creamy yellow to brownish lateral margins along the thoracic and abdominal segments. Full grown larvae may become 3 inches in length and are quite robust and conspicuous. Situated at the posterior end of the abdomen is an eversible organ with many finger-like processes which is reputed to be used as a "cleaning apparatus." Paiva described the procedure followed in cleaning the body with this organ. Larvae immersed in water extend the organ and possibly it has a respiratory function, for larvae immersed in water remained alive for more than 3 hours. The litter and soil in which the larvae live frequently become drenched during the monsoon rains, therefore, the ability to survive for hours immersed in water may be important to the species. Larvae are only active at night and are usually only seen during the rainy season when snails are active. Since larvae of various sizes were found from June, 1954, to March, 1955, and male adults were also collected each month throughout the same period, breeding and development probably occur throughout the year in the Kandy-Peradeniya area. However, in localities where there is a prolonged dry season both *A. fulica* and *L. tenebrosus* remain inactive during drought. Under insectary conditions Hutson and Austin found the larval period to be about 8 to 9 months.

Pupation occurs within chambers in the soil excavated by the larvae. The pupae are yellowish in color. Hutson and Austin found that the male pupae required from 16 to 23 days and the female only 7 to 10 days to complete their development and the adults to emerge.

Habits and occurrence of larvae

Attempts made during early June, 1954, to collect *L. tenebrosus* by searching for the larvae at night in the Kandy-Peradeniya area resulted in the procurement of very few larvae and it was decided that if large numbers were to be obtained for shipment to Hawaii it would be necessary to find a more effective method of collecting. Subsequently, studies were made to determine where the larvae could be found during the daytime. Some of the findings relative to the habits and occurrence of the larvae which might facilitate collection are discussed below.

Locomotion

At night when there was sufficient moisture for the larvae and snails to be active, larvae were seen crawling around over the litter. In this way they come in contact with snails which are their food. Often 2 or more larvae were seen crawling along together and in many instances more than one larva was found during the daytime partially inside of a shell of *A. fulica*. Furthermore, larvae found in the litter did not occur at random but frequently in groups. All of these suggest a somewhat gregarious behavior. Only about 1 out of 5 larvae found at night with the aid of an electric lantern were emitting light which means that only a small part of the population is conspicuous because of the light emitted. Gravely also observed that male adults did not emit light themselves when approaching virgin females that were emitting light.

Feeding

Larvae locate their snail prey at night as described above but many larvae remain partially inside snail shells throughout the day, apparently continuing to feed until the individual is devoured, or the larva engorged, which may require several hours. Immediately following a rain, especially after many days of drought, many of the larvae become active and feed voraciously. On such occasions probably half the larvae found during the daytime were partially within shells, apparently feeding. It was common to find medium to large individuals of *A. fulica* with 3 to 4 *L. tenebrosus* larvae partially within them. Small to medium sized individuals seem to be preferred to the large individuals, for in one area where both *A. fulica* and *L. tenebrosus* were fairly abundant, large larvae were found feeding on small individuals and there were more empty small shells than large ones. However, several freshly killed large individuals were seen in the field with larvae feeding on them. In the insectary, also, large individuals were readily attacked and devoured.

Shelter

Except when larvae and adults are active at night, they, as well as the eggs and pupae, are concealed or sheltered in the litter or soil. Not only are the larvae inactive throughout the day, but some apparently remain inactive in concealment for weeks while others of the same population are actively

feeding. Furthermore, during extended periods of drought, snails are inactive and *L. tenebrosus* larvae are not to be found above ground. Shelter of a somewhat superficial nature among loose leaves in the litter was adequate when conditions were favorable for feeding at night, such as immediately following a substantial rain. At such times when the litter was moist, larvae were commonly found covered by a single leaf, but as the litter dried out the larvae receded into the deeper layers of the litter where it was moist and cool for longer periods. In exceptional cases, immediately following rains, as many as 6 larvae were found in 1 square foot of litter and 50 larvae within an area of 100 square feet, while nearby only a few larvae could be found by searching through the litter over an area of hundreds of square feet. After the litter had dried out, larvae were only found in the soil but here also occasionally several larvae were found within a few inches of each other. Larvae were found to a depth of 6 to 8 inches in the soil, especially in the vicinity of rocks or in the walls of trenches or holes. In the cacao plantations in Pallekelle where I collected the majority of the larvae in 1954 and 1955, catch basins about 18 inches wide, 24 inches deep, and several feet in length had been dug to conserve moisture. Many larvae were collected in the leaves that accumulated in these catch basins and also in the soil walls. *A. fulica* also commonly found shelter within these catch basins. Larval molt skins were often found in vacated chambers in the soil, which suggests that not only egg deposition and pupation occur in the soil chambers but also molting.

Moisture

Activity of the larvae is affected a good deal by moisture. In fact, no activity was observed during prolonged drought periods which occur over much of Ceylon, where there are distinct wet and dry seasons. The majority of the larvae were collected in cacao plantations in Pallekelle about 15 miles from Peradeniya, but it is considerably drier during the summer months in these cacao plantations than in Peradeniya and Kandy. Larval activity was observed and good collecting was had in these cacao plantations immediately following the scattered rains that fell in June and July, 1954, but searching for larvae was ineffective in the same areas between rains and especially during the more prolonged dry period during the latter part of the summer. During the northeast monsoon rains in the fall, although larvae could be found at all times in these plantations, activity and feeding on any one day were apparently less than immediately following the intermittent rains during the summer and the beginning of the monsoon rains in the fall. Collecting again became more difficult after the dry season set in about the end of February.

Abundance and Economic Importance of L. tenebrosus

L. tenebrosus currently occurs in large numbers in certain areas where *A. fulica* is abundant in the hill country around Kandy and has been prevalent

in this general area for many years (Hutson and Austin). However, there are some localized areas in Pallekelle where *A. fulica* has been abundant for many years but *L. tenebrosus* was rare in these areas during 1954 and 1955. Furthermore, the observations made suggest that possibly *L. tenebrosus* is not adapted to such areas. The probable importance of *L. tenebrosus* if introduced into other countries to combat *A. fulica* is currently of considerable interest, therefore, it will be discussed in the light of the limited information available.

The highest population of *L. tenebrosus* encountered and the best collecting were in certain cacao plantations in the Pallekelle area where *A. fulica* was fairly abundant but not sufficiently abundant to warrant poisoning as was being done in many other parts of the plantation. The soil in these areas was a sandy loam, with higher fertility and moisture holding capacity than that of the poorer sites in the general area. In one of the sites on July 6, 1954, 97 larvae were collected from the litter (soil was not disturbed) in an area of approximately 4,000 square feet, which was at the rate of about 1,000 larvae per acre. Only a fraction of the larvae present were collected and larvae were collected again from this same area on several occasions during the summer and fall of 1954. There were 10 to 15 acres in each of two different sites of this type where more than 5,000 *L. tenebrosus* larvae were collected. There were many empty *A. fulica* shells in these areas and it seems likely that *L. tenebrosus* was an important factor influencing the abundance of *A. fulica*.

Within a few miles of the above areas where *L. tenebrosus* was abundant there were several places in cacao plantations where *A. fulica* was very abundant but *L. tenebrosus* rare. These areas were on outcroppings of limestone, with poor light sandy soils and low moisture holding capacity. During the dry season these areas were extremely dry; many of the cacao trees had died and others were stunted and making poor growth. It was recognized that the areas were sub-marginal for cacao, repeated replantings had failed, and there were only a few trees per acre that were productive. Each year for the preceding three years, an attempt had been made to convert many acres of cacao within these areas to pepper, but after each planting over 95 per cent of the pepper plants were destroyed by *A. fulica* even though an intensive poisoning program was carried out, sometimes as frequently as at 4 day intervals, during the season when there was enough moisture for snail activity. The foreman on the plantation stated that *A. fulica* had been continuously abundant in these particular areas for many years and that in spite of the recent intensive poisoning program snails were about as abundant in 1954 as 3 years before. Probably such areas are too dry or otherwise unsuited to *L. tenebrosus;* consequently, it has very little influence on the abundance of *A. fulica* in such areas.

In contrast to the above conditions encountered in Pallekelle, *A. fulica* and *L. tenebrosus* occur in small numbers throughout the nearby Peradeniya-Kandy area where there is a better distribution of the rainfall. In this area *A. fulica*

and *L. tenebrosus* are more or less continuously active throughout the year. Both species were more numerous in this area 30 to 40 years ago (Hutson and Austin) than now, but probably at the present time *L. tenebrosus* is more abundant in respect to *A. fulica* than it was when *A. fulica* was abundant, which suggests that this predator might be an important factor in the control of the snail in such areas.

Summary

L. tenebrosus, a voracious feeder on the giant African Snail in Ceylon and parts of India, has recently been introduced into other countries to combat this snail.

Hutson and Austin studied the life history of *L. tenebrosus* in the insectary at Peradeniya, Ceylon, and found that the life cycle was completed in a little less than one year. However, because in the field both *A. fulica* and *L. tenebrosus* are inactive during prolonged dry periods, the life cycle may be longer than one year.

The best places found for collecting *L. tenebrosus* readily in numbers were certain cacao plantations in Pallekelle where *A. fulica* was also quite abundant. In these particular areas the soil was a sandy loam, relatively fertile and the trees were growing well and productive. In contrast, larvae were extremely scarce in nearby areas on poorer and drier sites, even though *A. fulica* was very abundant.

Although the larvae are only active at night when the litter is moist, they could be found more readily during the daytime than at night. When conditions are favorable for feeding at night, the larvae coil up in the litter during the day. Rains apparently stimulate larval activity and the greatest numbers were found immediately following rains after several days of dry weather. During extended dry periods the larvae enter into the soil and therefore are more difficult to find then than when present in the litter.

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The Genus Mirosternus in Samoa and Fiji (Coleoptera: Anobiidae)

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(*Presented at the meeting of December 12, 1955*)

The information presented in this paper is based on 32 specimens of the genus *Mirosternus*. These apparently represent the first native Anobiidae in this genus to be described from Samoa and Fiji. The collection contains eight species, five from Fiji and three from Samoa.

There is no apparent division between the Samoan and Fijian species, and they appear to have evolved from common ancestors. This general observation was also made by P. A. Buxton (INSECTS OF SAMOA, part 9: 33–104, 1935) when he noted the affinities of the endemic insects of Samoa and Fiji. Therefore the species discussed in this paper have been treated together rather than separately.

The genus *Mirosternus* was described by Sharp in 1881 by combining the characters of seven endemic species from the Hawaiian Islands. I hereby designate *M. glabripennis* Sharp as the genotype. Perkins, in 1910, described 67 additional species from Hawaii. In 1924, Scott described two species from the Seychelles. I have additional species in manuscript from Micronesia. It is of interest to note that the presence of *Mirosternus* in these areas closes a large gap in the geographical distribution of the genus.

All specimens are deposited in the Bernice P. Bishop Museum, Honolulu.

Mirosternus Sharp

Mirosternus Sharp, 1881, TRANS. ENT. SOC. LONDON, pp. 522–526; Perkins, 1910, FAUNA HAWAIIENSIS 3:614–642; Scott, 1924, ANN. MAG. NAT. HIST. (9) 14(82):368–373.

Antennae eleven segmented, with the apical three segments forming a large club. Eyes globose and without a distinct emargination. Head with a small hollow under the eyes to receive the large basal antennal segment. Prosternum and mesosternum completely concealed when the insect is in repose. Metasternum produced anteriorly so that the middle coxae are widely separated, also with grooves for the reception of the middle legs. First visible ventrite produced in the middle forming a plate-like process between the hind coxae.

The Samoan and Fijian species of *Mirosternus* exhibit more pronounced inter-specific differences than the Hawaiian *Mirosternus*, which are all closely

related and appear to have evolved from one or two ancient introductions. The Hawaiian species frequently show sexual differences in the size of the eyes and the antennae, whereas in Samoa and Fiji there is no such apparent difference in these structures. In Hawaii the species are, as a whole, larger, more robust, and less pubescent. I have been unable to detect any means that would adequately separate the sexes of the species studied in this paper other than exposing the genitalia.

KEY TO THE SAMOAN AND FIJIAN SPECIES OF MIROSTERNUS

1. Hind intercoxal plate with sides straight, parallel or nearly so.....2
   Hind intercoxal plate with sides emarginate and converging posteriorly.....**vitiensis,** n. sp.
2. Each elytron with three prominent rows of serial punctures on the side, and an obscure fourth row above them; the outermost row extending to the apex.....3
   Each elytron without prominent serial punctures on the side.....4
3. Elytral pubescence strongly swirled and forming maculae variously disposed according to the direction of the hairs and the light reflected therefrom.....**samoensis,** n. sp.
   Elytral pubescence neither swirled nor maculate, but uniformly directed backward and slightly outward.....**perforatus,** n. sp.
4. Elytra moderately to densely pubescent; more than 2 mm.....5
   Elytra strongly shining, hardly at all pubescent on the disc; less than 2 mm.....**glabratus,** n. sp.
5. Interocular area more than twice the width of an eye.....6
   Interocular area less than twice the width of an eye.**zimmermani,** n. sp.
6. Pubescence swirled.....7
   Pubescence not swirled.....8
7. Pubescence golden.....**tangentus,** n. sp.
   Pubescence silvery.....**tangentus sericeus,** n. subsp.
8. Robust, black, with ashy pubescence.....**lindoroides,** n. sp.
   Elongate, dark brown, with golden pubescence.....**inornatus,** n. sp.

Mirosternus inornatus, new species

Male. Small, dark brown, moderately covered with golden pubescence directed obliquely backwards on the elytra and obliquely forward on the pronotum. Antenna small, with the first segment dark brown and the remainder testaceous; viewed laterally, the second segment globose and twice as long as the third; fourth segment smallest and closely joined with the third; fifth and sixth segments toothed inwardly and equal in length; seventh and eighth segments also equal in length but longer and more prominently toothed than the fifth and sixth; ninth segment slightly longer than the tenth, and slightly shorter than the eleventh; segments nine to eleven equal in width. Head with the eyes entire and half as wide as the distance be-

tween them; frontal groove between the antennal insertions deep and arcuate.

Pronotum finely and sparsely punctate; broader than long at the hind angles, but longer than broad at the front angles; side margins piceous and not joining with the front margin; strongly produced outward in front and partially covering the eyes when the head is fully deflexed. Elytron with the basal two-thirds blackish about the suture and sides; moderately punctate except for large, shallow, serial punctures on the basal third, these consisting of eight obscure longitudinal rows almost equally spaced between the side and sutural margins; row nearest the side margin extends to the apex where the punctures are more deeply impressed. Metasternum flat at the middle, with large, widely spaced punctures on the intercoxal process; linear depression at the middle very shallow except for a small, deep pit at the anterior end.

Abdomen with the intercoxal plate of the first visible ventrite as long as the fifth visible ventrite at the middle, black and rounded in front, the sides parallel, twice as long as broad.

Length: 2.2 mm., breadth: 1.4 mm.

Allotype: length: 2.3 mm., breadth: 1.4 mm. Similar to the male. Paratypes: four specimens measuring in length: 2–2.3 mm., breadth: 1.3–1.4 mm.

Holotype male (Bishop 2494), Malololelei Road, Upolu, Samoa, July 8, 1940, beating shrubbery, E. C. Zimmerman. Allotype, same data, 1,600–1,800 feet. Paratypes, two from the type locality, June 24, 1940, and July 8, 1940, same collector; one, Afiamalu, Upolu, Samoa, July 19, 1940, 2,100 feet, E. C. Zimmerman; one, Upolu, Samoa, July 24, 1940, E. C. Zimmerman.

Similar to *M. lindoroides*, n. sp., from Fiji, but slightly smaller, dark brown instead of black, and pubescence whitish instead of golden. *M. inornatus*, n. sp., also resembles *M. zimmermani*, n. sp., but the latter species has a large pubescent swirl directed obliquely backwards on the middle of each elytron, whereas *inornatus* has the pubescence directed uniformly backwards.

Mirosternus zimmermani, new species

Male. Medium size, dark brown, moderately covered with cinereus pubescence. Antenna with the first segment dark brown and the lateral carinae darker yet, the remaining segments lighter brown; second segment globose; third segment with the apex wider than the base; sixth to eighth segments produced inwardly; ninth and eleventh segments obviously longer and wider than the tenth segment. Head with the eyes two-thirds as wide as the distance between them, globose and entire; interantennal depression deep and arcuate.

Pronotum strongly transverse; sculpture fine on the disc but coarse laterally; side and hind margins darker than the middle; hind angles widely obtuse; front angles rather abruptly deflexed, and almost as widely separated as the hind angles. Elytron with the pubescence uniformly directed backward

and slightly outward except for an area at one-third from base and half distance from suture to side margin where pubescence is directed almost perpendicularly to the suture; very finely punctate except for three rows of obscure punctures on the basal third near the suture. Metasternum broadly produced anteriorly between the middle coxae; raised middle part with sparse but large punctures; medial groove not deeply impressed.

Abdomen with the intercoxal plate on the first visible ventrite glabrous and piceous anteriorly, slightly longer than broad, and the sides parallel; fifth ventrite longer at the middle than the preceding three ventrites; hind margin of first ventrite slightly produced backward at the sides.

Length: 2.6 mm., breadth: 1.5 mm.

Holotype (Bishop 2495), Tholo-i-suva, Viti Levu, Fiji, 500–700 feet, July 21, 1938, beating, E. C. Zimmerman.

Resembles *M. lindoroides*, n. sp., but it may be distinguished by a large swirl on the middle of each elytron directed outward from the suture, and by the large eyes, whereas *lindoroides* has the pubescence uniformly directed backwards and smaller eyes.

Mirosternus vitiensis, new species (figs. 4, 6)

Female. Elongate, somewhat cylindrical, dark brown, punctures strong but fine, with long, sparse, tangential, aeneous pubescence. Antenna with the third segment conical when viewed laterally, this two-thirds as large as the second segment; the club rather small with the tenth segment shorter than the ninth and eleventh. Head slightly expanded in front; eyes small and widely separated, only one-third as wide as the distance between them.

Pronotum with the margins darker than the disc; punctures very fine but deep, and so close together that many are joined creating a rough, shaggy appearance; moderately transverse; front angles strongly curved down and inwards and invisible dorsally; hind angles rounded and widely obtuse. Elytron two and one-half times longer than wide; color and pubescence similar to the pronotum; three rows of marginal punctures; outermost row extends from a point below the prominent humerus posteriorly to a large puncture near the apex, then basally, parallel with the suture, and ending at the middle of the declivity; innermost row originates a little below and behind the humerus and extends little past the middle; the latter consisting of only eight punctures; middle row nearly reaching the declivity, though obscure apically as the punctures become smaller and fewer. Metasternum with the punctures and pubescence finer than on the dorsal side of the insect, therefore more shining; intercoxal process truncate.

Abdomen with the intercoxal plate of the first ventrite arcuate in front, and at the sides converging behind; fifth ventrite slightly longer than the second, and one-third longer than the third or fourth.

Length: 2.5 mm., breadth: 1.5 mm.

Holotype (Bishop 2496), Navai Mill, near Nandarivatu, Viti Levu, Fiji, 2,500 feet, September 17, 1938, E. C. Zimmerman.

M. vitiensis, n. sp., is easily recognized by the very small eyes, somewhat cylindrical form, small antennal club, and the strongly arcuate sides of the plate between the hind coxae. The latter character alone will separate *vitiensis* from any other known species.

Mirosternus perforatus, new species (fig. 3)

Male. Dorsum with rather sparse, light brown, semi-erect pubescence; integument black and strongly punctate. Antenna testaceous except the first segment which is darker; segments nine to eleven slightly longer than all the others combined; third segment nearly as long as the second, but converging behind; ninth segment about as long as segments two to eight combined, and longer than the tenth, which is semicircular in lateral aspect; eleventh segment longer than the tenth and about equal in length to the ninth. Head evenly rounded in front; punctures smaller and shallower than on the pronotum; interocular area two and one-half times as wide as the width of an eye; eyes feebly emarginate above the antennal insertion.

Pronotum with the punctures as wide as the average distance between them; hardly explanate laterally; almost twice as broad as long at the hind angles, but slightly longer than broad at the front angles; front angles sharply defined and barely acute. Elytron with the punctures slightly denser than on the pronotum and slightly wider than the distances between them; laterally four rows of punctures more or less following the contour of the side margin; these rows becoming increasingly shorter inwardly, so that the row nearest the suture consists of six shallow punctures, and the row next to it extends from the humerus to a point a little past the middle; row nearest the side margin extends from base to apex, and contains large deep punctures. Metasternum uniformly punctate, evenly rounded, except for a feebly impressed longitudinal line extending from the middle to the hind intercoxal plate.

Abdomen with second and fifth, and third and fourth ventrites about equal in length, but the third and fourth shorter than the second and fifth.

Length: 2.6 mm., breadth: 1.6 mm.

Allotype: similar to the male.

Holotype male (Bishop 2497), Amouli, Tutuila, Samoa, 800–1,000 feet, August 2, 1940, E. C. Zimmerman. Allotype female, Malololelei Road, Upolu, Samoa, July 8, 1940, 1,600–1,800 feet, O. H. Swezey.

M. perforatus Ford is quite distinct from any other species, though it resembles *M. vitiensis* Ford in being strongly and deeply punctate and with three rows of punctures on the side of the elytra, but *vitiensis* is more elongate, more pubescent, and the punctures denser but smaller.

Mirosternus samoensis, new species (figs. 2, 5)

Male. Robust, dark brown species with dense, tangential pubescence on the dorsum reflecting aeneous or fuscus, and appearing maculate. Antenna (fig. 2) with segments nine to eleven slightly longer than the combined lengths of the others; tenth segment shorter than segments nine and eleven; first segment very large, convex outwardly and concave inwardly, with a carinate hood-like process extending over the point of insertion of the second segment; segments three to eight very small and combined about as long as one and two combined; segments four to eight with a small projection on the inner side, which is most prominent on the seventh segment. Head moderately pubescent and punctate; distance between the eyes about twice the width of an eye; a feeble impression between the eyes about twice the width of an eye; a feeble impression between the antennal insertions; when fully deflexed one-third of the eyes is hidden under the prothorax.

Pronotum strongly transverse, and densely covered with mostly golden, recumbent setae, though, to a lesser extent, with semi-erect setae; recumbent hairs in patches or swirls diverted in different directions so that the light reflected therefrom gives the impression of maculae; margins sharp throughout; front angles rounded; side margins explanate. Elytron with the pubescence arranged similarly to that of the pronotum, but differing in the absence of erect setae and the presence of three longitudinal, sinuate, dark purple stripes extending from the base to a large patch of similar color on the declivity; also in the presence of a similar stripe along the suture; four rows of serial punctures on the side following the contour of the lateral margin; the row nearest the lateral margin, being the longest and having the largest punctures, extends to the apex; inwardly, the other three rows with increasingly smaller punctures and shorter length, so that the row nearest the suture is barely visible; second row originates just below the humerus and extends a little past the middle. Metasternum flat at the middle with an elongate fovea extending from just before the middle to the hind intercoxal plate; anterior metasternal process blunt and evenly rounded; immediately posterior to the middle leg receptacle are large punctures which become smaller posteriorly and disappear before reaching the suture separating the metasternum from the antecoxal sclerite.

Length: 2.8 mm., breadth: 1.7 mm.

Allotype: similar to the male.

Holotype male (Bishop 2498), north side Pago Pago, Tutuila, Samoa, 900–1,200 feet. Allotype female, Afiamalu, Upolu, Samoa, 2,100 feet, beating shrubbery, July, 1940, E. C. Zimmerman. Paratype, same data as the holotype.

Distinct from all the others by the dense and greatly swirled pubescence, but allied to *M. perforatus* Ford in having the three rows of prominent punctures on the sides of the elytra.

Mirosternus glabratus, new species (fig. 7)

Female. Very small, reddish brown, shining, with the pubescence extremely sparse. Antenna in lateral view with the third segment converging behind; segments four to eight equal in length to the ninth segment; ninth segment little longer than the tenth and slightly shorter than the eleventh; apical segment almost one-third longer than the tenth segment. Head sparsely setose, the hairs as long as half the width of an eye and arising from very fine punctures; eyes globose and entire.

Pronotum moderately deflexed at the sides; margin darker than the disc; pubescence similar to that of the head, but denser on the sides near the front angles where the punctures are more conspicuous; hind angles broadly obtuse; front angles rather sharply acute. Elytron shining and without setae except at the sides; nine rows of indistinct serial punctures extending from the base and becoming less conspicuous apically until they disappear on the declivity; with a deep groove extending from the base just below the humerus to the apex where it is more deeply impressed and with larger punctures, and this groove interrupted near the middle of a group of large irregularly spaced punctures. Metasternum rather strongly swollen at the sides; the middle with shallow, sparse, evenly distributed punctures.

Abdomen with the intercoxal plate of the first ventrite as wide as long, and the sides subparallel; fourth ventrite shorter than the others.

Length: 1.2 mm., breadth: 1.0 mm.

Allotype: same as the female.

Paratypes: three specimens measuring 1.2–1.3 mm.

Holotype female (Bishop 2499), Mvana, Vanua Mbalavu, Fiji, 200 feet, August 9, 1938, beating shrubs, E. C. Zimmerman. Allotype, Tholo-i-Suva, Viti Levu, Fiji, June 29, 1924, E. H. Bryan, Jr. Three paratypes, same data as type.

M. glabratus Ford is easily distinguished by its small size and extremely sparse pubescence on the dorsum.

Mirosternus lindoroides, new species

Male. Large, black, moderately punctate, with fine, sparse, cinereous, semierect pubescence on the dorsum. Antenna with the first segment ovate from in front; third segment laterally triangular, and two-thirds as long as the second; segments four to eight very small, and feebly produced inwardly; eighth segment smaller than any of the others; segments nine and eleven about equal in length. Head with a deep, sinuous impression in front between the antennal insertions; slightly, obtusely, emarginate at the front; eyes about half as wide as the distance between them, slightly flattened in front and at the sides.

Pronotum with the side margins not quite reaching the anterior margin, hence the front angles feebly defined; hind angles obtusely rounded; twice

as broad as long. Elytron with punctures shallow and widely separated, therefore the surface somewhat shining; with five rows of large, shallow, longitudinal, sutural, serial punctures extending from the middle almost to the base, and a sixth row nearest the suture but half as long as the others. Metasternum containing a medial linear impression; anterior intercoxal process not strongly produced, and with a deep depression just behind, and following the contour of the front margin.

Abdomen with the hind intercoxal plate of the first visible ventrite wide, truncate behind, the sides diverging anteriorly, and the front margin arcuate.

Length: 2.8 mm., breadth: 1.8 mm.

Allotype: similar to the male.

Paratypes: fourteen specimens, length: 2–2.7 mm., breadth: 1.5–1.8 mm.

Holotype male (Bishop 2500), Navutu-i-loma, Lau, Fiji, August 10, 1924, E. H. Bryan, Jr. Allotype female, Vanua Mbalavu, Lau, Fiji, September 20, 1924, E. H. Bryan, Jr. Paratypes, Ongea, Lau, Fiji, August, 1924, E. H. Bryan, Jr.; one mile south of Marona, Mango I., Lau, Fiji, beating shrubbery, 200–300 feet, August 14, 1938, E. C. Zimmerman; Lami Quarry, near Suva, Viti Levu, Fiji, 10–250 feet, August, 1938, E. C. Zimmerman; Belt road, forty-five miles west of Suva, Fiji, July 26, 1938, beating shrubs, E. C. Zimmerman; Vanua Mbalavu, Lau, Fiji, 200–300 feet, August 10, 1938, E. C. Zimmerman; ridge west of Nandarivatu, Viti Levu, Fiji, 2,500–3,000 feet, September 9, 1938, E. C. Zimmerman; Navai Mill near Nandarivatu, Viti Levu, Fiji, 2,500 feet, September 17, 1938, E. C. Zimmerman; Yuvutha, Yangasa Cluster, Fiji, August 11, 1924, E. H. Bryan, Jr.

M. lindoroides Ford is easily recognized by its large size and ashy pubescence uniformly directed backwards on the elytra. It is closely allied to the Samoan *M. inornatus* Ford, but *inornatus* is smaller, brown instead of black, and the pubescence golden.

Mirosternus tangentus, new species (fig. 1)

Male. Small, dark brown, robust, with a dense covering of sericeous, golden, tangential pubescence. Antenna, viewed laterally, with the second segment globose; third segment conical, nearly as long as the second; segments four to eight very small, feebly produced inward; ninth segment as long as segments four to eight combined, longer than the tenth, but shorter than the eleventh. Head finely punctate and moderately pubescent; eyes small, slightly flattened in front, and a little less than half as wide as the distance between them.

Pronotum with the punctures fine, less than twice as wide as the distance between them; strongly curved inwards at the sides so the fore and hind angles are invisible from above; with dark and light patches disposed according to the direction of the hairs and the light reflected therefrom; anterior margin produced outward at the juncture of the anterior and side

margins, forming a receptacle for the eyes when the head is deflexed. Elytron with the pubescence disposed similar to the pronotum; humerus prominent; a single marginal stria extending from the base to the apex, with fine punctures basally, in the middle obscure, but large and deep near the apex; four longitudinal rows of large, shallow serial punctures on the disc; the three outer rows extending from the base almost to the middle; the row nearest the suture but half as long as the others. Metasternum very wide and flat at the middle, the sides swollen; a prominent linear depression at the middle extending from the hind margin two-thirds the distance to the fore margin; large punctures on the anterior intercoxal process becoming fewer and smaller posteriorly.

Abdomen with the sides of the hind intercoxal plate nearly parallel.

Length: 2.2 mm., breadth: 1.5 mm.

Holotype male (Bishop 2501), ridge west of Nandarivatu, Viti Levu, Fiji, 2,600–3,000 feet, September 9, 1938, beating shrubbery, E. C. Zimmerman. Paratype, Tholo-i-suva, Viti Levu, Fiji, 500–600 feet, August 21, 1938, E. C. Zimmerman.

M. tangentus Ford may be distinguished from the other species with greatly swirled pubescence by its smaller size, and the swirls being differently directed. *M. samoensis* Ford has light fuscus pubescence and a deep medial line on the metasternum, but *tangentus* has bright golden pubescence, and less prominent medial line on the metasternum. *M. vitiensis* Ford is readily distinguished by the divergent sides of the hind intercoxal plate, which are nearly parallel in *tangentus*.

Mirosternus tangentus sericeus, new subspecies

Male. Apparently identical to *M. tangentus* Ford except that the pubescence is bright silvery instead of bright golden.

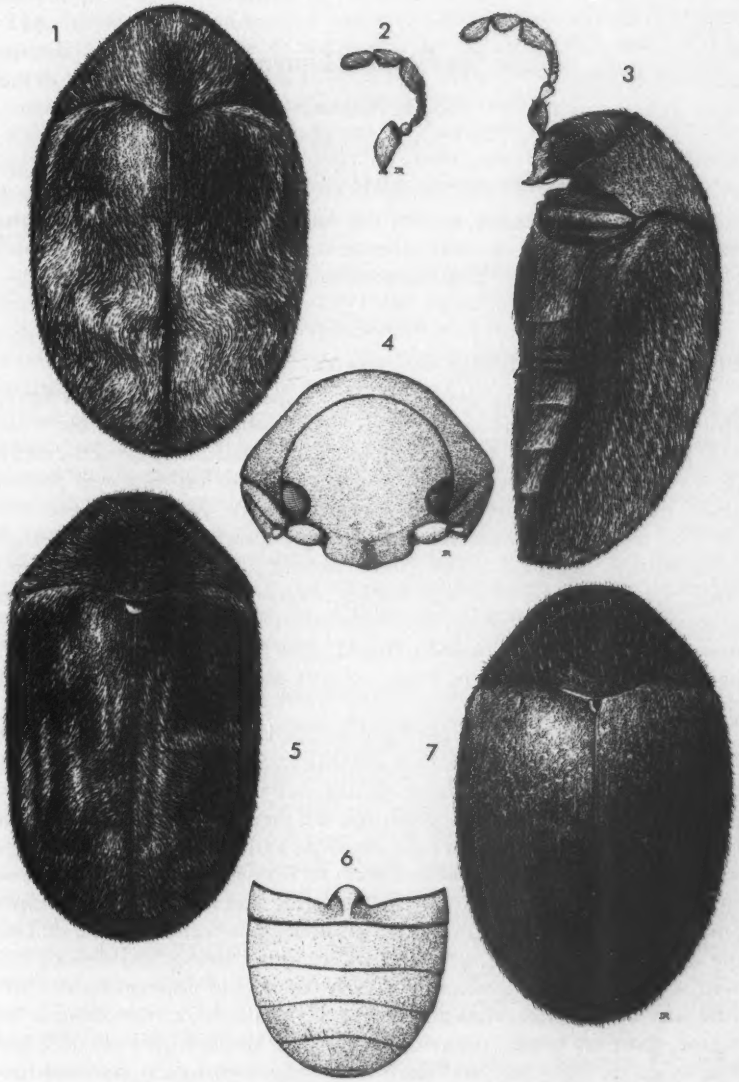
Length: 2.2 mm., breadth: 1.5 mm.

Holotype male (Bishop 2502), Bavatu, Vanua Mbalavu, Fiji, August 16, 1938, beating shrubs, E. C. Zimmerman. Paratype, one mile south of Marona, Mango I., Lau, Fiji, August 14, 1938, E. C. Zimmerman.

ACKNOWLEDGMENTS

I am indebted to E. H. Bryan, Jr., for the loan of the specimens alluded to in this paper, and to Dorothy Rainwater for preparing the illustrations.

FIG. 1. *Mirosternus tangentus*, n. sp.
FIG. 2. *M. samoensis*, n. sp. Antenna.
FIG. 3. *M. perforatus*, n. sp.
FIG. 4. *M. vitiensis*, n. sp. Head.
FIG. 5. *M. samoensis*, n. sp.
FIG. 6. *M. vitiensis*, n. sp. Venter.
FIG. 7. *M. glabratus*, n. sp.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New Species of Hymenoptera

D. T. Fullaway

HONOLULU, HAWAII

(*Presented at the meeting of October 10, 1955*)

It is desired to describe as new the following species of Hymenoptera which either have lain in local collections for years with doubt as to their identity, or have recently been discovered.

Braconidae

Blacus cremastobombyciae, new species

Female. Two mm. long, dark ochraceous, legs and abdomen basally lighter. Head transverse, as wide as the thorax, length about two-thirds the width. Eyes fairly large, convex, black; ocelli small, also black, situated in the middle of vertex, arranged in form of an isosceles triangle, less than one diameter apart, about four diameters from inner margin of the eye and two from occipital margin. Antennae attached at upper margin of the face on slight protuberances, concolorous but darker outwardly, slender, almost as long as body; scape and pedicel a little thicker, flagellum 13-segmented. Occiput concave and smooth, shining, head otherwise coriaceous, dull, clothed with short silvery fuzz. Temples wide, convex; face fairly flat, declivous or lying in a different plane from the front; clypeus distinct, clypeo-ocular groove short but cheeks fairly wide.

Thorax and abdomen of about equal length. Prothorax triangular, narrowing anteriorly; mesonotum a little wider than long, slightly convex, declivous laterally behind, parapsidal grooves distinct but extending caudally only two-thirds the length of the mesonotum and not meeting posteriorly. Scutellum triangular, longer than wide at base, declivous at the sides; prescutellar sulcus wide and deep, divided by costae to form six fossae; there are also two small, smooth pits posteriorly on the scutellum somewhat in advance of the apex. Surface of the thoracic tergites to the propodeum is coriaceous and dull like the head; the mesopleura, however, are smooth, shining, and divided by a vertical groove. The propodeum is slightly convex and sloping caudally, with a median longitudinal carina and completely areolated, surface more or less rugose; there are lateral concavities at the base and the sides are declivous. The wings are fairly long and narrow, the stigma triangular, its width one-half its length, lying at about middle of wing; 1st cubital cell and discoidal cell separated, not confluent; recurrent nervure joins cubitus in advance of 1st cubital cross-vein; radius and cubitus short beyond 1st cubital cross-vein

and fading out beyond, no second cubital cross-vein; nervus parallelus meets nervellus and anal vein at about middle. Legs long and slender.

The abdomen is elongate oval, the 1st tergite ligulate and more or less perpendicular to the plane of the following tergites, which are convex, smooth and shining, declivous at the sides. The ovipositor, which is black, is exserted about one-fourth the length of the abdomen.

Described from one female specimen (marked type) reared from *Cremastobombycia lantanella* Busck in Honolulu, Hawaii, in 1955 by Miss Mabel Chong. Type deposited in collection of the Hawaiian Entomological Society.

Orgilus swezeyi, new species

Female. Four mm. long, black, mostly dull but temples and occiput, mesopleura, abdomen dorsally shining; antennae distad of scape for three-fourths of its length, mandibles, clypeus, legs (except front tarsi and basal trochanter), also ovipositor (but not the valves) yellowish to reddish brown; wings subhyaline, faintly tinged with fuscus, the stigma and veins mostly light brown.

Head as wide as the thorax, the occiput slightly concave; vertex, face and genae appearing smooth and shining but under high magnification actually microscopically punctate. Eyes oval and convex, posterior orbits prominent, almost as broad as the width of the eye; ocelli in a compact triangle medially on fronto-vertex and slightly raised. Face bulging to some extent. Front hollowed some for the insertion of the antennae, which are not especially slender and have a tendency to curl apically; the scape and pedicel several times thicker than the flagellum, which is 26-segmented, 1–13 longer than broad, the first three times as long as broad, the second twice, apical segments except last quadrate.

Mesoscutum fairly closely and shallowly punctate and clothed with silvery hairs; parapsidal grooves foveolate, converging posteriorly and joining in front of the posterior margin. Scutellum slightly convex, smooth and shining, prescutellar sulcus almost effaced; propleura strongly rugulose, mesopleura smooth and polished with the sternauli foveolate. Propodeum without carinae, mostly rugulose, with the base before the spiracles smoother and with an apical depression on each side of the middle which is mostly smooth; propodeum sparsely punctate on the sides, strongly punctate along the apical margin, and smooth and polished in the anterior dorsal area. Hind coxae sparsely punctate; longest hind tibial spur half the length of the 1st tarsal segment. Inter-cubitus and 2nd abscissa of the radius forming a nearly straight line, stub of the cubitus beyond the inter-cubitus slightly longer than the 2nd abscissa of the cubitus.

Abdomen slightly longer and a little narrower than the thorax; 1st tergite entirely and the 2nd for the most part finely rugulose punctate, the base, apex and lateral margins of the 2nd narrowly smooth, tergites beyond the 2nd polished. Ovipositor about 2.5 mm. long, valves slender and black.

Male. Four mm. long, black, more shining than female; only anterior margin of the clypeus, legs (except trochanters, tarsi in part and hind coxae basally) brown; antennae with 30 segments in flagellum; propodeum rugose; prescutellar sulcus conspicuous, wide and deep and divided into four sections by weak costae; metanotum a transverse band with front and hind margins carinate and a medially divided furrow lying between, the latter with rather weak costae; abdomen dorsally smooth and shining except for lateral wings of the 1st tergite, which are longitudinally striate.

Described from one female (type), Koko Head, Oahu, March 17, 1934, O. H. Swezey; one male (allotype), Koko Head, Oahu, reared from *Opogona*, February 13, 1934, O. H. Swezey; one female (paratype), Koko Head, Oahu, February 5, 1911, D. T. Fullaway; one male (paratype), Waialua, Oahu, January, 1944, D. T. Fullaway. Type, allotype, and one paratype deposited in the collection of the Hawaiian Entomological Society, one paratype in that of the Board of Agriculture and Forestry.

Phanerotoma myeloisae, new species

Female. Four mm. long; brownish yellow, the eyes, ocelli, a spot in the depression on each side of the postscutellum, irregular-shaped maculae on abdominal tergites black or blackish, the propodeum more or less infuscate; wings hyaline, costae brown, stigma and internal veins paler; second cubital cell quadrate, radius with three abscissae, 1st and 2nd almost continuous in a straight line, the former one-third the length of the latter, the two together at right angles with third.

Sculpture of vertex coarsely reticulate, the face, mesonotum and pleura finely shagreened, propodeum and abdominal tergites rugulose, 1st and 2nd abdominal tergites longitudinally striate. Antennae inserted on front of head at median level of eyes, which are subcircular, convex and somewhat bulging, antennae 20-segmented, about as long as body, scape broader than pedicel and flagellum and four times as long as wide. Ocelli arranged in a close triangle in middle of vertex, one and one-half diameters removed from occipital margin, which is deeply inflexed, three from ocular margin. Clypeus wide and semicircular in shape. Genae and temples broad. Occiput deeply eroded.

Propodeum sloping behind. Hind femora and tibiae somewhat swollen.

Abdomen sessile, depressed anteriorly where joined to thorax. Ovipositor protruding slightly.

Described from one female (type) and two males (allotype and paratype) collected in Honolulu by E. M. Ehrhorn (type) and D. T. Fullaway (others), date of collection not noted. Type and allotype in the collection of the Hawaiian Entomological Society, paratype in that of the Board of Agriculture and Forestry. This is the insect referred to by Swezey (PROC. HAW. ENT. SOC.

3:108, 1915) as *Phanerotoma* sp., from *Myelois ceratoniae* Zeller infesting the pods of *Acacia farnesiana* (L.) Willdenow (klu).

EULOPHIDAE

Tetrastichus (Epitetrastichus) beardsleyi, new species

Female. One and one-half mm. long, ochreous to dark ochreous. Head transverse and rather thin; smooth and shining with sparse needlepoint punctuations. Eyes comparatively small and red; ocelli red also, centrally arranged on vertex in almost a straight line transversely, about one diameter apart, one and one-half diameters from laterals to eye margin. Antennae concolorous, attached at middle of face above the level of an imaginary line joining the lower corners of eyes and fairly widely separated at base; consisting of scape, pedicel, three-jointed funicle and three-jointed club. The ring joints are leaf-like and four in number; the scape is elongate but not reaching top of head, expanded inwardly so that width at widest part in the middle equals about one-fourth length; pedicel obconic, less than one-half length of scape. Funicle joints subequal in length, slightly longer than wide but individually shorter than pedicel, club expanded more than the scape, 2nd and 3rd segments indistinctly separated, the individual segments nearly subequal in length, combined not quite as long as the combined funicular segments, ultimate segment pointed and terminating in a style; all the flagellar segments beset with follicular hairs. Face slightly convex, the anterior margin of the clypeus notched slightly with a pair of tooth-like projections; clypeoocular groove distinct.

Thorax and abdomen elongate and robust, the latter considerably longer than the former, which with the head is considerably darker; the thorax is a little deeper than wide, the prothorax more or less conically produced. The mesonotum is scutate between the parapsides, the shield a little longer than wide, but including the lateral wings the mesonotum is about quadrate and slightly convex, with two bristles on each lateral margin, one near caudal end; the scutellum is about the same, the longitudinal grooves distinct; there are also two bristles on each lateral margin. The pleura are divided by vertical carinae; the metanotum is narrow and transverse; the propodeum is short and declivous, with spiracles large and conspicuous. The legs are fairly stout, concolorous but a somewhat paler shade. The wings are as long as the body and fairly wide, the discal setae short and close-set, clothing entire wing save for a small basal area and a narrow basal caudal strip where a single line of three or four setae is present; the marginal setae are fine and fairly long, especially outwardly where they reach about one-fourth the width of the wing. The marginal vein is somewhat longer than the submarginal, the stigmal diverging at a 30° angle and about one-third the length of the marginal with three or four pustules at apex; the marginal vein bears nine bristles, the submarginal three.

The abdomen is more or less oval in shape, deeper than the thorax and pointed apically; the ovipositor extends considerably beyond its apex, the cerci and spiracles of 8th segment lateral in position.

Male. Similar except for sexual differences, e.g., the antennal scape in the male has a long carina on anterior inner side almost its entire length bearing a long seta, also an elongate oval vesicular sensorium on the inner margin about one-fourth its length, and all the segments of the flagellum except the pedicel have long setae mostly arranged in fascicles and more or less whorled.

Described from six female and four male specimens collected on manienie grass (*Cynodon dactylon* (L.) Persoon) at Waipio, Oahu, in July, 1955, by J. W. Beardsley, and mounted on a common slide; type female and allotype ringed with asphaltum. Types in collection of the Hawaiian Entomological Society.

Biographical Sketch of Dr. R. C. L. Perkins

D. T. FULLAWAY

HONOLULU, HAWAII

(*Presented at the meeting of October 10, 1955*)

On September 30th, 1955, word was received in Honolulu of the death at age 89 of Dr. Robert Cyril Layton Perkins on the previous day in England, where he had lived in retirement on account of poor health since 1912, mostly at Newton Abbott in Devonshire, where his father, who was a Church of England clergyman, had lived.

Some time after his graduation from Oxford University with a B.A. degree, he was engaged by a joint committee of the British Association for the Advancement of Science and the Royal Society of London to explore the land fauna of the Hawaiian Islands with the assistance of the Bishop Museum of Honolulu. He arrived in Honolulu to begin this work early in 1892 and continued at it until 1902. He collected on the six largest and most lofty of the eight chief islands of the archipelago and it was estimated that more than one hundred thousand specimens were obtained. In this *tour de force* he spent long periods in the cold and wet mountainous country at remote camps with inadequate shelter and food, and it is believed the exposure and privations suffered whilst in the field affected his health and led him to seek rest in a more congenial climate ultimately. Most of the specimens he collected were packed and sent to England for study but some groups Dr. Perkins worked himself, notably the aculeate and (in part) the parasitic Hymenoptera, the Proterhinidae, Anobiidae, Cioidae, the Strepsiptera, Neuroptera, and the Orthoptera. As a result we have the FAUNA HAWAIIENSIS, in three volumes, over two thousand pages, quarto size—a really monumental work. In the Introduction, which he wrote in 1910 from his notes, but which was not published until 1913, he states that altogether he spent twenty years working on the Hawaiian fauna. This masterpiece of exposition gives a most comprehensive account of the insect life of the islands and must serve as the basis from which all succeeding students of Hawaiian insects proceed. In acknowledgment of his valuable contribution to this great work he was given the degree of Doctor of Science by his alma mater in 1909.

Dr. Perkins was a strong supporter of biological control and as early as 1897 published an article in NATURE stating in a very lucid manner his reasons for believing it the method best suited to our need in Hawaii.

In 1902, with collecting for the "FAUNA" finished, Dr. Perkins became a consultant at the Territorial Board of Agriculture and Forestry and worked

in collaboration with Prof. Albert Koebele on the introduction of insects from Mexico to destroy the lantana plant, a pasture weed that was spreading rapidly due to the recently introduced Chinese dove's spreading the seeds; the first attempt, I believe, to use insects to control weeds. He also took charge of the inspection of plants and seeds coming into the Territory and was thus instrumental in keeping out many new insect pests.

In August, 1904, he transferred to the Hawaiian Sugar Planters' Association Experiment Station to work with Prof. Koebele on biological control of the cane leafhopper, *Perkinsiella saccharicida* Kirkaldy, which in the few years preceding had nearly ruined the sugar industry. This insect was first observed in the latter half of 1900 and nearly a year elapsed before its importance was recognized. Another year was spent in learning its identity and point of origin. When eventually its origin was traced to seed cane importation from Australia, Dr. Perkins went thither with Prof. Koebele to search for natural enemies. They arrived in Queensland in June, 1904, and immediately began collecting material for shipment to Honolulu. This was principally cuttings of cane leaves containing leafhopper eggs heavily parasitized by *Paranagrus* and *Ootetrastichus*. Later cages containing living plants well stocked with leafhopper and parasites were employed. The material so shipped was handled in Honolulu by Messrs. Swezey, Terry and Kirkaldy, who had been added to the staff. The introduction and establishment of these and other parasites and predators sent was successful and soon all the plantations were supplied with enemies of the hopper and damage was effectively stopped. An account of this work is contained in BULL. 1, DIV. ENT., H.S.P.A. EXPT. STA., largely written by Dr. Perkins himself. Dr. Perkins returned to Honolulu at the end of 1904 but Prof. Koebele continued in the field and spent some time in Fiji in 1905. In fact, Dr. Perkins was still working on this and other sugar cane insects when I arrived in Honolulu in 1908, although Prof. Koebele had gone, and I have always considered myself fortunate in making the acquaintance of this talented man. I was just a youthful beginner then, breaking into an entirely new situation. I really needed help to get myself oriented. In all my contacts with Dr. Perkins, I found him congenial, considerate and most helpful. Although extremely busy himself, he never hesitated about giving you his time and attention, and his suggestions were always good and gratefully accepted. However, his health was not good, and he moved again to England with Mrs. Perkins in 1909, not returning until May, 1912, when he came alone and stayed only a few months to complete some work on the Introduction. Whilst remaining in England he was still serving as a consultant on an honorarium from the Hawaiian Sugar Planters' Association.

Entomological Investigations in New Guinea Mountains[1]

J. L. GRESSITT

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(*Presented at the meeting of December 12, 1955*)

This is a preliminary report on my first trip to New Guinea. Since it is made before study of any of the material collected, and before identification of most of the host-plants, it consists mainly of notes on the environment and collecting in the areas visited. The trip was made possible by a John Simon Guggenheim Memorial Foundation Fellowship. I spent from June 5 to September 25, 1955, in New Guinea and New Britain. The objectives of the trip were (1) to collect insects primarily in new or relatively uncollected mountain areas in the interior of New Guinea in order to gather more data towards an understanding of the zoogeography of New Guinea insects, (2) to obtain material to be used in comparative studies in aiding the collaborators of the INSECTS OF MICRONESIA series to identify Micronesian genera and to help them to work out the zoogeography of the Micronesian insect groups they are studying, and (3) to help develop a representative collection from the Papuan area at Bishop Museum towards an understanding of the source-areas of the oceanic Pacific insect fauna.

It is assumed that much of the oceanic Pacific insect fauna originated from the major islands stretching between the Solomons and southeast Asia, perhaps in the main from New Guinea, eastern Indonesia and the southern Philippines.

Since rather little insect collecting has been done in the high mountain areas of most parts of New Guinea, I spent most of my time in the mountains. The principal insect collecting in New Guinea has been in the coastal areas or mountains along the north coast, as well as in the extreme west end (Vogelkop) and in scattered parts of Papua. The most extensive entomological survey in the interior was made by L. J. Toxopeus (PROC. EIGHTH INT. CONGR. ENT. 508–522, 1950) and his staff on the Third Archbold Expedition (Netherlands Indian-American Expedition) during 1938–39, when collecting was done systematically at all altitudes from just above sea level to nearly the highest altitudes in westcentral New Guinea (eastcentral Netherlands New Guinea), from the Mamberamo River where it reaches the lowlands, southwest to the Mt. Wilhelmina area in the Snow Mountains. Other ex-

[1] Partial results of a John Simon Guggenheim Memorial Foundation Fellowship, 1955–56. Revision of Presidential Address, December, 1955.

tensive mountain collections were made by Miss Evelyn Cheesman at Kokoda on the Owen Stanley Range in 1933, and in other mountains such as the Cyclops Mountains (1936) near the north coast of the central portion, and Waigeo (1938); by C. T. McNamara on Mt. Lamington (near Kokoda) in 1929; by the Second Archbold Expedition in the Upper Fly River area of western Papua in 1936–37; by P. J. Darlington in the northeast in 1944–45; by E. O. Wilson in eastern New Guinea in 1955, and others. Most other collecting has been in lowland areas, except some done recently by J. J. H. Szent-Ivany.

With the expectation of further trips to the New Guinea area (now assured by invitations from the Departments of Agriculture of the Territory of Papua and New Guinea and of the British Solomon Islands Protectorate, and a grant from the National Science Foundation), I decided on this first trip to visit several widely separated areas at different altitudes, in order to obtain as broad a sampling as possible, at the same time collecting in new or little-collected areas.

The planning and arranging of my trip was very materially aided by the suggestions of Drs. J. J. H. Szent-Ivany, H. Boschma, M. A. Lieftinck, and L. B. Holthius. Extensive assistance in the field was rendered by the departments of agriculture of the Territory of Papua and New Guinea, and of Netherlands New Guinea, and especially by Dr. J. J. H. Szent-Ivany, Mr. J. S. Womersley, Mr. L. A. Bridgeland, Dr. F. C. van Loenen, Mr. R. T. Simon Thomas, and Mr. R. den Haan. Further help was given by Ian Downs, G. P. Keleny, R. S. Carne, J. Sharp, Fr. M. E. Bodnar, Fr. J. Labor, F. Pemble-Smith, F. Shaw Meyer, Dr. and Mrs. A. Handsoo, A. J. Slatter, K. R. Gorringe, the South Pacific Lumber Co., W. J. Hughes, Mr. Wyttewaall, Mr. Veldkamp, L. E. Laurens, Rev. and Mrs. Troutman, L. Pospisil, and many others. Assistance in collecting was obtained locally in each area. Dr. Szent-Ivany accompanied me during my first 12 days, and loaned me his assistant, Edmund, for the following week. Mr. Simon Thomas accompanied me during my month in Netherlands New Guinea.

In order to supply material to all collaborators on the INSECTS OF MICRONESIA project, all groups of insects and other terrestrial arthropods were collected. Emphasis was placed on the insect groups better represented in Micronesia: Coleoptera, Homoptera, Heteroptera, small moths, and other small insects. Since many of these are nocturnal, special emphasis was placed on light-trapping. Much general sweeping and beating was done, and also considerable Berlese-funneling. The light trap and Berlese-funnel were of the same types as used in Micronesia (INSECTS OF MICRONESIA 1:202, 1954). Nets used were primarily heavy sweeping nets, a collapsible-frame beating sheet, improvised beating sheets (fig. 9c), butterfly net, water net, and organdie net. Little emphasis was placed on butterflies, since they have been better collected than other groups and are poorly represented in Micronesia.

The general areas visited during the trip were the Port Moresby area in Papua, the "Eastern" and "Western Highlands" of northeast New Guinea, the Lae area of the Huon Gulf, Hollandia, Biak Island, the Wisselmeren (Wissel Lakes) area of westcentral Netherlands New Guinea, and the Gazelle Peninsula of Northeastern New Britain. Collecting was done at all altitudes from sea level to 4,600 meters, although no insects were taken above 4,200 meters.

Papua

My trip commenced at Port Moresby, Papua, June 5, 1955. Here the climate is quite dry for New Guinea, with only 1,000 mm. of rain per year, and average humidity of 60–95 per cent. In this dry area *Eucalyptus* trees are dominant, and the fauna is atypical for New Guinea, with Australian types predominating. The widespread *Oecophylla* ants are numerous among the *Eucalyptus* trees. Two days were spent with arrangements and procuring equipment, and two days were spent collecting at Bisianumu, alt. 500 meters, at edge of foothill rainforest in a rubber-growing region. Here rainfall is about 2,500 mm. per year and vegetation is lush jungle. At the Rubber Experiment Station, many kinds of insects were collected on flowering *Crotalaria*, grown as a cover crop. Several kinds of cerambycids and weevils were found ovipositing on *Hevea* rubber bud stock. A *Pantorhytes* (a genus which includes serious pests of cacao) weevil was found in jungle. Bisianumu was again visited September 23–24. A short stop was made at the Brown River, also near Port Moresby.

Northeast New Guinea Highlands

The second destination was Goroka, in the Eastern Highlands of Northeast New Guinea, by air via Wau. Goroka is in the Asaro Valley, at 1,550 meters, southeast of Mt. Wilhelm, and east of the Wahgi and Chimbu valleys. The Asaro is wide, flat, and grassy, with forested ranges over 3,000 meters high on each side. It drains into the Purari River, to the Gulf of Papua. At Goroka interesting telephorids, weevils, and chrysomelids were found on introduced ornamental plants, vegetables, sugar cane, *Pipturus*, and others. A *Coptorrhynchus* weevil had just become a pest of coffee, and a melolonthid and ants were causing injury to airstrips. *Casuarina*, bamboos, *Eucalyptus deglupta* Blume, and other plants present were possibly introduced by the natives. *Poinciana* was found crowded with elephant beetles, and *Papuana* dynastids were taken in the light trap.

The next locality (June 11–16) was Daulo Pass, northwest of Goroka, on the Chimbu-Asaro Divide, at 2,450 meters, with the ridge going higher in both directions. Collecting was done up to 3,000 meters. Moss forest included small *Pandanus*, *Freycinetia*, small bamboos, *Nothofagus*, lianas, and *Rhododendron*, among a very rich variety of vegetation. A tall apparently

WAIGEO
BIAK
JAPEN
NETHERLANDS NEW GUINEA
ARU (AROE)
Hollandia
NORTH-EAST
NEW GUINEA
PAPUA
Wewak
Madang
MANUS
NEW IRELAND
Rabaul
Baining Str.
NEW BRITAIN
Lae
Buzu
Bubia
Port Moresby
Bisianumu
Cape York
Tenge
JIMMI V.
Wan
Tapibeger
Karop
Ilonz
Mt. Wilhelm
Aunde L.
Teramamburo
CHIMBU
Nohbu
Karowagi
Hondagi
WAHGI V.
ASARO V.
Mt. Otto
Miramar
Doulo
Goroka
Okaisori
PANIAI LAKE
Kuridu
Obano
TAGE LAKE
Wagupa
Ijaiwa R.
ITIGI LAKE
KAMO VALLEY
Ugapuga
Nduma

semi-cultivated *Pandanus* with long red fruit grows near the villages. Though the weather was cool, insects were abundant. Many moths flew at night as it generally rained in afternoon and evening. Two male hercules moths were taken by Dr. Szent-Ivany. Rainfall is probably over 3,000 mm. per year.

After returning to Goroka, I went to Mr. Otto (June 20–24) on the east side of the Asaro Valley. The east rim at this point is higher, overlooking much of the ridge on the west side of the valley. The upper portions of the ridge are largely covered with moss forest. Parts of the highest peaks (3,300 m.) are grassy, the result mainly of fires kindled by native hunters to warm themselves, or to provide hunting places. Tree kangaroos and other marsupials and some rodents occur in these situations. I camped on the lower side of the mountain, at Kabebe village, at 2,100 meters. Collecting was done on the main ridge, and also lesser ridges to the west, just north of the village. The area was largely forested, with some new or old clearings, mostly for sweet potato, with *Pandanus* near the village. *Cordyline* was a very common plant, particularly bordering the sweet potato patches. Here the chrysalis of a *Troides* (*Ornithoptera*) was found on the underside of the large leaf of a shrub, at 2,200 meters. The butterfly emerged some days later and was thought to be a species described from the Owen Stanley Range to the east.

Leaving Goroka again, June 27, I rode north up the Asaro Valley to Miramar, through grassy country with *Casuarina*, *Cordyline*, *Ficus*, and other familiar plants. Miramar, 1,800 meters, is north of the road leading to Daulo Pass, and is at the foot of the west wall of the valley. Next day, with porters, I walked further north, past Gobayabe, and part way up the ridge to two round huts, at Nenguag, on a side ridge near the main ridge. June 29 we climbed up over the main ridge at Bogonege, 3,000 meters, where the view included both the upper Asaro Valley, with various mountains, including Mt. Monisa and Mt. Otto to the east, and westward across the Upper Chimbu Valley to the slopes of Mt. Wilhelm, its peaks hidden in clouds. On the ridge, again, was moss forest, with small bogs here and there. A short distance west from the ridge we came to a large shallow grassy valley. Repeated burning kept this in grass, with tree ferns surviving in spots. Passing through some natural forest we reached an upper branch of the Chimbu Valley with signs of dense population. Sweet potato fields extended from 2,500 meters altitude down to the river. Crossing the stream, we visited a village where the people were coming in for a "sing-sing". We had to cross another steep ridge, then descend to the west fork of the Upper Chimbu, and proceed up it, and then a short distance up a branch to the west, to reach Toromomburo, 2,350 meters (or Denglagu as it is often called—the name of the local tribe).

FIG. 1. Map of New Guinea and New Britain, showing collecting areas. Inset of Wisselmeren area (stippled on large map) on lower left; inset of route in Asaro, Chimbu, Wahgi, and Jimmi valleys (stippled on large map) on lower right.

a
b
c
d

The next morning, June 30, with new porters, I started up Mt. Wilhelm, first passing the airstrip, Keglsugl, 2,500 meters, and then entering wet moss forest. At about 3,200 meters the deep moss forest gave way to open grassy areas with scattered tree ferns, and shrubbery or small groves on the slopes. After five hours we reached Lake Aunde, lowest of three lakes below the higher peaks. Here, at 3,600 meters, we camped for two nights in what seemed like near freezing weather at night. The surroundings were grassy with dense thickets of shrubbery or stunted trees, with trees up to 12 meters or more tall in protected situations. There were still many kinds of plants, and a type of moss forest, but with obvious differences reflecting low temperatures and strong wind. On the more exposed slopes the dense growth could hardly be penetrated, and in the open the grass was deep and thick, making progress difficult.

On July 1 the ascent was made on up the mountain, passing Lake Piunde and then two small ponds. From the ridge just below the main peaks, at 4,200 meters, Lake Gurauraga was seen below in the valley to the west. This was the highest point at which insects were taken. Several flies and spiders were obtained in low shrubs on the ridge. Because of clouds higher up, this was also the highest point at which scenery was seen: the Sarowaged Mountains well to the northeast, the Owen Stanleys far to the eastsoutheast, and many nearer ranges. Keeping near to the tops of the rock slides from the granite peaks, we worked around to the north, and finally two of us climbed to the summit of a peak which I later learned was the second-highest, some 4,600 meters, on the basis of data in the record left there the previous year by the official Wilhelm patrol. A single small woody plant was found growing a few meters below the summit of the peak, considerably higher than the highest bunch-grass seen. Cold rain hampered collecting on the descent to Lake Aunde. With parts of three afternoons, one morning's collecting, and two nights' light-trapping, around Lake Aunde, we took about 200 species of insects and other arthropods, at 3,600 meters. Dominant insects were caddis flies, small moths, homopterans, beetles, and flies. Many of the plants at this altitude and above belonged to the Ericaceae.

No conifers were seen at these high altitudes, but mostly below 2,000 meters, and hardly ever in solid stands. This correlates with Toxopeus' (1950) statement that New Guinea has no true alpine insect fauna, but rather that the lowland insects have recently been adapting themselves to the higher altitudes, as the young high mountains of New Guinea have been elevated just to the south of remnants of a lower ancient Melanesian continent. No pines, for instance, occur, but mostly *Araucaria*, *Podocarpus*, and cupressine trees.

FIG. 2. *a*, Brown River lowland rain forest, near Port Moresby, Papua; *b–d*, Mt. Wilhelm, Northeast New Guinea; *b*, just below Lake Aunde, 3,550 meters; *c*, Lake Aunde, 3,600 meters, looking northwest; *d*, Lake Aunde, looking east.

Returning to Toromomburo, more collecting was done in that valley (fig. 4c) which drains from Lake Gurarurага, which was seen from above, and also in the rain forest above Keglsugl. Caterpillars of the hercules moth (fig. 4b) were brought in on *Homalanthus populneus* (Geiseler) Pax. Leaving Mt. Wilhelm on July 5, I started south down the upper Chimbu Valley, which leads into the east end of the Wahgi Valley. In the lower part of the Chimbu some limestone cliffs may be seen from a distance, and there are also limestone caves. Along these streams, and on the cultivated slopes and by villages, *Casuarina* is dominant. However, it was never seen in unpopulated areas, suggesting that it has been planted by the natives, as has the kamerere (*Eucalyptus deglupta*). *Casuarina* is of wide distribution, but the kamerere is rare or lacking in natural stands in the lowlands, except in New Britain and on the summits of some low extinct volcanoes on the mainland of New Guinea.

After passing Gembol and Womukamu, I turned up another tributary, to the northwest, near Gogme, in order to collect on another ridge, by entering the Wahgi Valley farther to the west. Spending the night at Numbu, at nearly 2,000 meters, the next morning the pass, Kukumbagl, was crossed at 2,700 meters. Descending the west side of the ridge to Bogo, there was more natural forest and many butterflies, particularly *Delias*, along the small streams where the trail, and a little lumbering, allowed sunshine to penetrate the forest. Coming out of the narrow valley, we reached Kerowagi, on the north side of the wide Wahgi Valley. Thus I had walked from the center of the "Eastern Highlands" to the border of the "Western Highlands," by a devious route. From Kerowagi south across the valley, an excellent view is had of the great Kubor Range, forming the south wall of the valley. Several of its peaks are over 4,000 meters high.

I spent from July 7 to 11 at Nondugl, location of the Hallstrom Trust animal farm and zoological garden. The latter includes large aviaries housing many of the birds of paradise, cassowaries, parrots, and marsupials of the neighboring regions. Collecting was done in remnants of forest on local hills, and on the slopes of the Ahl Valley descending from the Sepik-Wahgi Divide to the north. A common tree in cultivated areas here, as well as in the Asaro and Chimbu Valleys, is *Dammaropsis kingiana* Warburg which has very large leaves and fruit, and is sometimes called breadfruit.

From Nondugl I was driven to Banz, farther west, and 11 "boys" I employed to accompany me to the Jimmi Valley went ahead by foot. On the 11th after a drive west to "Wadda Kar" we started climbing the Sepik-Wahgi

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FIG. 3. Mt. Wilhelm, Northeast New Guinea: *a*, tree ferns in grassy valley at 3,000 meters; *b*, edge of scrub by Lake Aunde, 3,600 meters; *c*, above lakes, approaching main peaks, showing bunch grass, small shrubs, and 4,200 meter pass in upper center, above Lake Gurarurага; *d*, looking down on two small ponds (left foreground), Lake Piunde, and Lake Aunde from 4,000 meters.

a
b
c
d

Divide. First we passed swampy kunai grass country on the valley-floor, partly being eliminated for coffee cultivation; then cultivated areas mixed with shrubby slopes, *Casuarina*, and *Pandanus*, and higher up, natural forest, still with *Pandanus*. Crossing the divide at 2,200 meters, we started down the north side, into the Jimmi Valley in the southeastern Sepik drainage. On this side, the slopes and the valley bottoms were much more wooded. The human population was much sparser, and mostly limited to medium high slopes. In the higher Wahgi, Asaro, and particularly the Chimbu Valley, the human populations are probably the densest in New Guinea, and the correlation of absence of malaria at the higher altitudes seems quite clear.

The village of Dori, at 1,650 meters, was passed in the afternoon, and the night spent at Wana, 1,500 meters, the same level as the floor of the Wahgi Valley. The next day we descended the ridge to a low stream, at 900 meters, went up a branch stream, then up to a ridge again. The night of July 12 was spent at Korop, 1,300 meters, on a ridge like Dori. The light trap here produced an estimated 5,000 specimens, in great variety of species.

The next day, proceeding mainly westward and a little north, we descended through largely natural forest to a river at 760 meters, then over a pass at 1,030 meters, then along a ridge, past Kumur village, at 1,170 meters, down to another tributary of the Jimmi at 750 meters, and up a partly cultivated slope with some second growth to Tsenga, at 1,230 meters. Here we stayed in the "house kiap" for three nights. Along the ridge there were *Casuarina* trees, some banana plants, *Pandanus*, and overgrown fields. We collected on forested ridges up to 1,500 meters or more, and down to the river at 700 meters. Near the river was jungle, but a little higher were groves of the cultivated *Pandanus*, called "mareda."

On July 16 we moved down a low ridge towards the Jimmi River, through fields, grass, bamboo, and forest, to Wum (Um), at 840 meters. This was the lowest village in this part of the valley, and was rather new. Clearings were being made in the jungle which provided very good collecting on dead branches, stumps, and logs. Very tall *Araucaria* trees towered high above the jungle in a rather even sprinkling, over a large area. On the 17th some of us went down to the Jimmi River, at 460 meters, all the way through virgin jungle, quite damp and warm, and with not many insects in evidence. Though I had assumed I might find considerable endemicity in the Jimmi Valley, some of the larger beetles taken around Wum were of familiar north coastal species. However, the rest have not yet been studied.

FIG. 4. Northeast New Guinea highlands: *a*, branch of Asaro Valley leading to Kabebe, Mt. Otto, with *Papuacedrus* in foreground; *b*, larva of hercules moth, Toromomburo, Mt. Wilhelm; *c*, valley just above Toromomburo; *d*, floor of Wahgi Valley, from just north of Banz, looking south; *e*, above Kabebe, 2,250 meters, Mt. Otto at right; *f*, near pass, 2,700 meters, between Numbu and Kerowagi (between Chimbu and Wahgi valleys).

From Wum we returned to the Wahgi Valley by another route, farther east and nearer Mt. Wilhelm, again a three-day walk. On the 19th we retraced the route to the Jimmi, crossed it, and proceeded through jungle, across a low ridge, then up to the crest of the main ridge between the two main branches of the Jimmi, in line with the main river to the west and half way between the Bismarck Range and the Sepik-Wahgi Divide. From the village at the crest, we proceeded east along the ridge, in part at 1,600 meters. There were bamboos, *Cordyline*, some quite tall betel-like palms, and native forest on the slopes, with a bit of moss forest at the highest point. Reaching Tapibagar, 1,400 meters, where the ridge meets another from the south, it was grassy, with a few large *Araucaria* trees. The next day we walked south along the ridge, going up and down between 1,300 and 2,000 meters. At one spot, north of Koronondu, at 1,475 meters, there were two kinds of *Araucaria*, a cupressine tree, perhaps *Papuacedrus papuanus* (F. v. Mueller) Li, and *Casuarina*, betel-like palms, two or three species of bamboos, and a tall straight *Pandanus* with large leaves. The night of the 20th was spent at Karap, on the same ridge, at 1,550 meters. The next day the route continued south on the ridge, up and down, until the Sepik-Wahgi Divide was reached at Tumbul, near Memiz, at 2,500 meters, in boggy moss forest, above the *Nothofagus* forest. We traversed the ridge west for some distance before turning south down into the Wahgi, still to the east of the point at which we had entered the Jimmi. On the upper slopes, the large black broad-nosed weevils, as found at Daulo Pass, were common on the tops of shrubs, but disappeared lower down. We reached the road on the east side of Banz.

On July 23 I left Banz, flying to Goroka, and then Lae. Because of a storm between the Wahgi and Asaro valleys, we flew west, then north, up the Wahgi Valley, over the lower Jimmi, around the Bismarcks, over the middle Ramu, then over Bundi and past the north side of Mt. Wilhelm, which had received a snow fall during the storm, before entering the Asaro from the east.

Three days were spent at Lae, shipping specimens and collecting in jungle clearings and in second growth, at close to sea level. Both plants and insects, of course, were largely different from those in the highlands.

Netherlands New Guinea

On July 27 I flew from Lae to Hollandia, via Madang and Wewak, and the next day, with Mr. Simon Thomas, from Hollandia to Biak in the Schouten Islands. On Biak I ran the light trap, and collected in second growth north of the airfield, and also visited jungle, with scattered *Agathis*, near the agricultural school in the center of the island. The former was all coralline, the latter partly of volcanic rock. On the 30th we flew to the Wisselmeren

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Fig. 5. Jimmi Valley, Northeast New Guinea: *a*, Wahgi-Sepik divide on south side of Jimmi Valley; *b*, *Araucaria* standing above jungle at Wum, 750 meters; *c*, upper Jimmi River, 500 meters; *d*, looking across valley from between Tapibagar and Korop.

(Wissel Lakes) area of westcentral Netherlands New Guinea, almost directly south of Biak, crossing Japen Island and leaving the sea near the head of Geelvink Bay. We landed on Paniai Lake, the largest of the three lakes, by the settlement of Enagotadi (Enarotali), government headquarters for the highlands. Twenty-two days were spent in this area, visiting the three lakes, and the Kamo Valley to the southwest, a marshy remnant of a large fourth lake.

The Wisselmeren area consists of marine limestone of not very ancient age, perhaps mostly middle Tertiary, again indicating the relative youth of the high interior areas of New Guinea. The altitude of Paniai Lake is 1,742 meters, and it is by far the largest lake. Tage Lake, the smallest and the middle one, is seven meters higher than Paniai, and drains into it through crevices in the limestone ridge which rises five meters above the surface of Tage. Tigi Lake, the southernmost, drains underground to the Oeroemoeka or Jawei River which starts as the outlet of Paniai Lake at its southeast end, near Enagotadi. Formerly, the outlet was at the opposite northwest end, near Waipa, where a deep canyon falls away into the Siriwo River and Geelvink Bay, whereas the outlet now enters the Coral Sea. There is apparently still shifting going on in the rocks. The night before our departure there was quite a strong and long earthquake. The lakes, particularly Paniai, are being reduced in size by deltas of incoming streams turning shallow portions into marshes (fig. 10a). The greatest measured depth of Paniai Lake is 49 meters. The lakes are inhabited by interesting crayfish, but apparently only one species of fish.

Collecting was done from July 30 to August 7 (except day collecting of August 4) on the hills immediately south and east of Enagotadi, at altitudes of 1,750 to 2,050 meters. Most of the collecting was in shrubbery at the edge of forest, and wood-cutting trails through native forest. The forest was of the *Nothofagus* and moss forest types, somewhat similar to those in northeastern New Guinea, but with some noticeable differences, including more Asian types familiar to me, such as *Rhododendron*, Melastomaceae, etc. Some of the common types near Enagotadi are *Evodia*, *Dacrydium*, *Xanthomystus*, *Phyllocladus*, *Mearnsia*, *Wrightia*, *Polyscias*, *Vaccinium*, *Claoxylon*, *Dodonaea*, *Poikilogyne*, *Acalypha*, *Glochidion*, *Ascarina*, *Papuacedrus*, and *Podocarpus*. *Casuarina* grows in the village area, as well as *Piptadenia*. Stag beetles of the genus *Lamprima* were found abundant on the new leaves of citrus trees recently established.

Tage Lake was visited on August 4, walking from Wotai near the start of the Jawei River, and over a low rise. The edge of the lake is marshy, with tall grasses, but there are also trees growing in the marshy areas.

FIG. 6. Near Enagotadi, Paniai Lake, Netherlands New Guinea: *a*, looking north from moss forest, 2,000 meters; *b*, moss forest; *c*, looking northeast, over *Nothofagus* forest; *d*, sweet potato fields near lake, 2,000 meters.

a
b
c
d
e
f

Okaitadi was visited from August 7 to 9. It is located at the west end of Paniai Lake, in a valley between two steep ridges. The floor of the valley is marshy or gravelly, with various grasses and canes. We collected mainly on the north slope, where we operated the light trap. Plants collected here included *Acalypha*, *Schefflera*, *Saurauia*, *Sloanea* and *Gleichenia*.

Obano, in a similar valley draining into the westernmost bay of Paniai Lake, was the next stop. Collecting was done only on the south side of the valley, in second growth. The next day, August 10, we made the long walk from Obano to Ugapuga (Urapura), in the northeast part of the Kamo Valley. The route crossed two passes, of 2,080 and 1,820 meters, the floor of the Kamo at Ugapuga being about 1,530 meters. In the upper part of the valley leading from the lake to the first pass, a landslide the year before had somewhat altered the course of some streams, the main stream at this time being on the side of the valley. With depletion of suitable trees for the large dugout canoes around the lake, canoes are now made in the upper Kamo Valley, and hauled by large gangs over this pass.

Near Ugapuga there are a number of *Araucaria* trees, and plants collected here included *Melastoma*, *Uncaria*, *Macaranga*, *Schefflera*, *Poikilogyne*, and *Rapanea*. Collecting was done in small clearings on the forested hill behind Ugapuga. On August 12 I walked down the swampy valley to Itouda, near the south end of the valley. The marshy area was largely grassy, sometimes partly open, and at intervals there were swampy forests or small thickets of *Pandanus* with a few shrubs. The *Pandanus* was of a type with the fruit spiny and in close bunches. Itouda is at the foot of a steep limestone ridge on the east side of the valley. There is a fair sized pond connected with the river at Itouda, alt. 1,500 meters. Collecting was done on the valley floor, and also on the forested or cultivated portions of the steep ridge to nearly 2,000 meters, including moss forest and some stunted growth on rough portions of the limestone ridge. On August 14 collecting was done in the upper end of the Dabei Valley, over a lower portion of the ridge to the south. There is much limestone outcropping here. The lower end of the Dabei drains into Tigi Lake. Plants collected at Itouda included *Acalypha*, *Ficus*, *Glochidion*, *Triumfetta*, and *Eulalia*, the latter grass with a new species of *Brontispa*.

With the help of J. Pospisil of Yale University, with whom I stayed at Itouda, I obtained a list of insects eaten by the local Me or Ekagi (Kapauku) people. The list includes six common spiders, including three of conspicuous coloration, four types of tettigoniids, a gryllacridid, several locusts, including *Oxya* and *Locusta*, a mole cricket, a small flat green mantid, cockroaches, two types of large pentatomids (including one which once squirted

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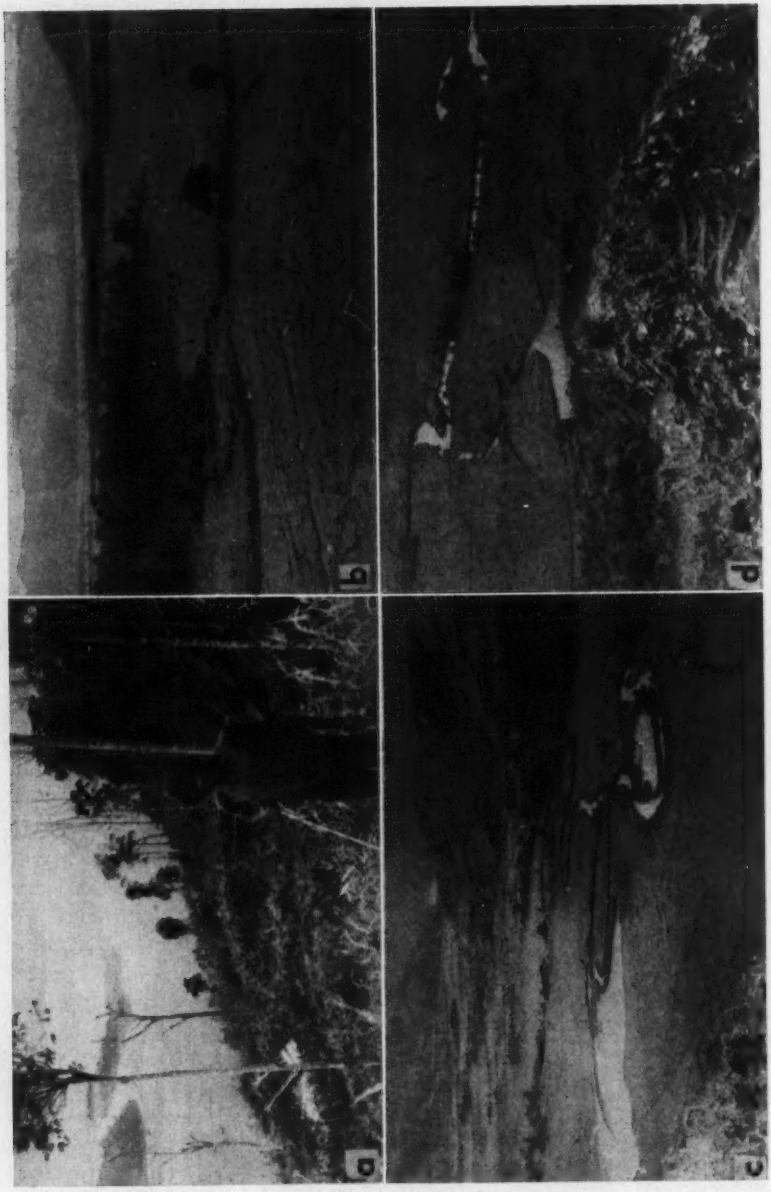
FIG. 7. Wisselmeren, Netherlands New Guinea: *a*, between Jawei River and Tage Lake, 1,800 meters; *b*, sweet potato field near Tage Lake; *c*, Tage Lake; *d*, along trail from Obano to Kamo Valley, starting ascent to pass from behind marshes; *e*, delta on Paniai Lake below Duroto; *f*, below forest, behind Enagotadi, Paniai Lake.


b
d
a
c

me painfully in the eye), three types of coreids, gerrids, damsel flies, dragon fly nymphs and adults, a large broad-nosed weevil, and *Polistes* wasps (larvae and pupae). Among insects considered inedible are various beetles, Lepidoptera, asilids and other flies, ants, and meliponid bees. The wax of the latter is used.

From Itouda I returned to Ugapuga, and on the 16th we climbed over the pass, eastward, to Tigi Lake. Again the valley entering the lake was marshy with scattered small thickets of shrubbery. We reached the lake at Itorikebo (next to Gakokebo) at the northwest end, and crossed the lake to Wagete. At the mouth of the Dabei Valley and back from the southwest shore were forests of trees which from a distance appeared as if dead, but I failed to identify them. Above the marshes here the country was largely plateau of limestone sand, with humus in the forested areas, and some slightly lower streams. Between Wagete and the Jawei river there are several contrasts of vegetation types. On some of the higher flat limestone sand country there were reasonably pure stands of conifers, generally *Dacrydium* and *Papuacedrus* mixed together, with a few shrubs and sedges. The ground was marshy, but fairly solid where the white coral sand was pure, though generally with water standing on the surface. Farther northeast the vegetation was mixed, with more of the widespread trees and shrubs, and the spiny *Pandanus* was common. We reached the Jawei River at Prauw Bivak (Bivak Perahoe), and returned to Enagotadi by boat. After three more days of collecting, two around Enagotadi and one at Duroto (Daroto) at the end of a ridge north and across marshes from Enagotadi, we returned to Biak and then Hollandia by the same route, except for a brief stop at Suarei on Japen Island. In flying from Biak to Hollandia good views were had of the extreme meandering of the Mamberamo and other rivers on the extensive flat coastal areas of northern New Guinea, and likewise with the Sepik and Ramu between Wewak and Madang.

At Hollandia, I collected on August 24 (dry season) on grassy slope and fragments of jungle on south side of valley near Hollandia Stad, partly near where the light trap was operated July 27 and August 23–24, and also across the valley in nearly dry sago palm swamp and on forested hillside and edge of cultivated areas.

New Britain

Flying from Lae to Rabaul, on August 27, I proceeded to Keravat and spent a week at the Lowlands Agriculture Experiment Station. August 28 was spent along old jungle roads overgrown with *Alpinia;* the 29th on a trip to coconut plantations along the coast across the Gazelle Peninsula, in

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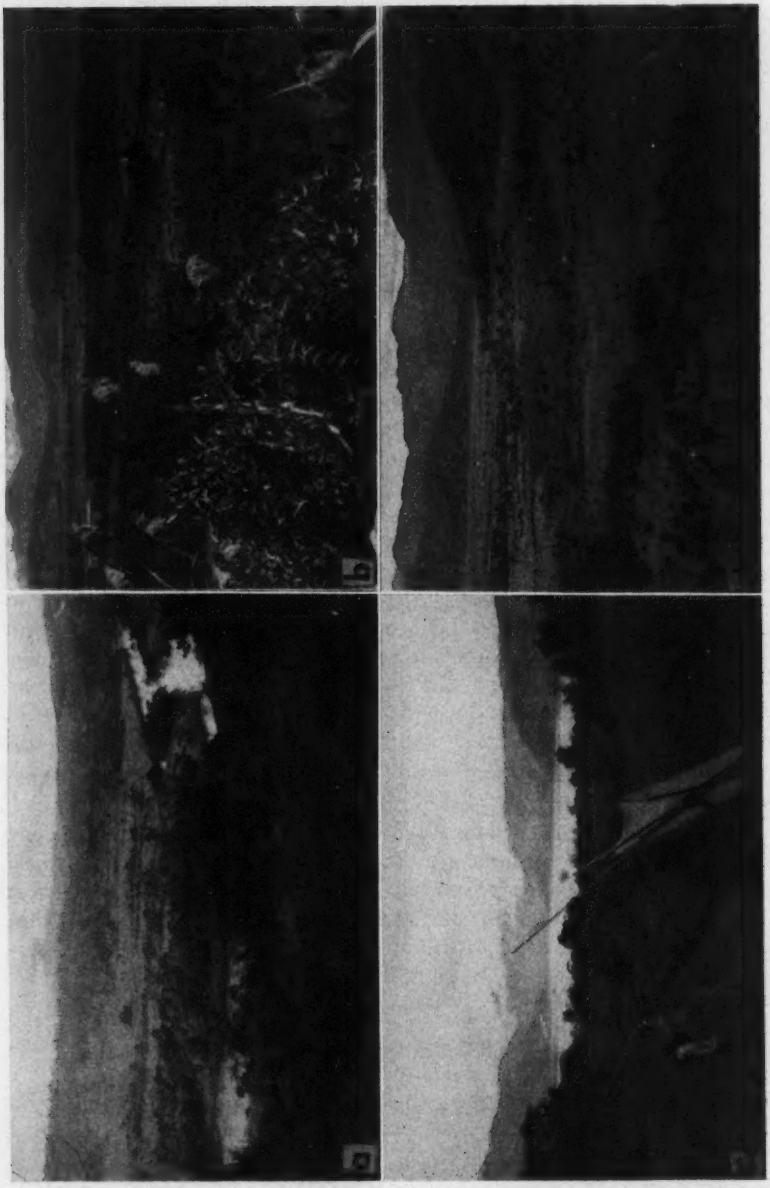
Fig. 8. Kamo Valley, Netherlands New Guinea: *a*, clearing in moss forest, 1,800 meters; *b*, swampy forests and marsh between Ugapuga and Itouda, 1,500 meters; *c*, lower end of valley, Itouda by pond at left; *d*, looking down from limestone ridge behind Itouda.



the Kokopo area. The rest of the time was spent on the flat valley bottom along the road through the experiment station to the foresting areas in jungle along the river. Each day a different area was sampled, mostly in the jungle, but partly in second growth being cleared. The light trap was also operated at each of these points and in clearings near forest behind the station. In much of the jungle area, the kamerere (*Eucalyptus deglupta*) towered above the jungle in scattered growth and was being lumbered. Among plants collected here were *Mallotus*, *Macaranga*, *Ficus*, *Polytoca*, *Inocarpus*, *Saurauia*, *Clerodendrum*, and *Pipturus*.

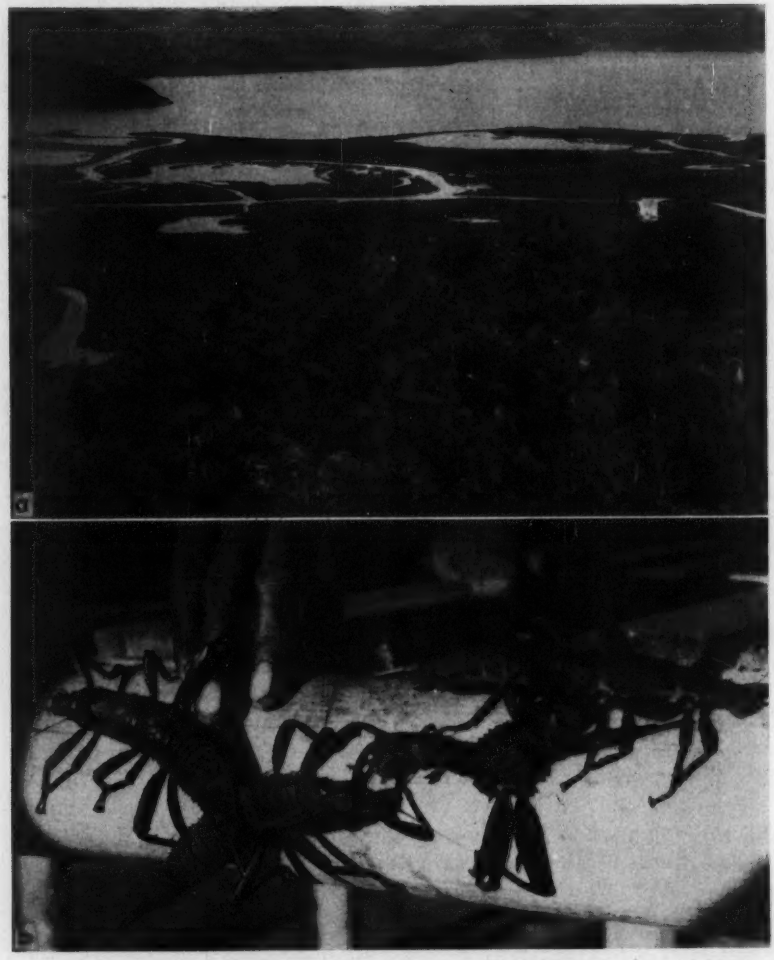
St. Paul's village in the Bainings Mts. on the southwestern side of the Gazelle Peninsula was the next destination. I stayed there from September 3 to 10. The village is a short distance up hill, at 260 meters, from Neu Mobisberg Plantation, slightly inland from Vunamarita and New Masawa Plantation. Above St. Paul's the trail inland continues a considerable distance at about 350 meters altitude along the side of the ridge, and collecting was done along this almost every day for several kilometers. Twice (4th and 9th) the ridge was ascended to different points, and one day (7th) also by a roundabout route from the former mission grounds below the village. As an organdie net was used quite a bit here, more smaller Hymenoptera and Diptera were taken. Among plants collected for host data here were *Piper*, *Lepistemon*, *Pipturus*, *Saurauia*, and an urticaceous plant. Coconut palms grew up the the trail at one or two places and other palms grew in the jungle. A large phasmid, *Eurycantha* sp., appeared to be fairly abundant here. Returning to Keravat on the 10th, I had two more days of collecting, in places similar to those tried during the longer visit.

Lae Area, Northeast New Guinea

Returning to Lae September 13, I spent from the 14th to 17th at the Busu River, east of Lae. This is rich jungle area, with foresting going on in fairly flat country at the edge of foothills of the Rawlinson Range, just south of the Sarowaged Range, about 100 meters altitude. Collecting was done in partial clearings where there were felled trees or stumps and branches.

From September 17 to 20 I stayed at the Bubia Agricultural Station, up the Nadzab Valley about 20 kilometers northwest of Lae. Here, again at about 100 meters or less, collecting was done in clearings in lowlands jungle, at the edge of cacao plantations, in sago swamps, and on forested hillsides at the edge of the valley. The light trap was operated on a low ridge overlooking a small valley behind the station. This was the last collecting locality, except for Sept. 21 to 25 in the Port Moresby area again, visiting some of the same localities.

Fig. 9. Wisselmeren, Netherlands New Guinea: *a*, Jawei River, between Wagete and Prauw Bivak; *b*, Kamo Valley, middle portion; *c*, Tage Lake, beating sheet in foreground; *d*, upper portion of Kamo Valley.


a
b

SUMMARY

Though it is impossible to give an adequate summary before studying the collections, a few general impressions might be noted. In general, conspicuous Australian types of insects appeared relatively rare, or restricted to the Port Moresby area, among those visited, except for a few cases of widespread forms. As noted by Toxopeus (1950) there appears to be no true alpine fauna in New Guinea. Forms at high altitudes appear different from those at lower altitudes, but often belong to the same genera as found in the lowlands. Certain genera seem to be quite restricted in altitudinal range, and others to occur from sea level to highest altitudes. Considerable differences in faunal makeup appeared evident in separated areas, but again certain genera seemed to be of general representation. Between the areas visited in the highlands of Northeast New Guinea and westcentral Netherlands New Guinea, where collecting was done largely at similar altitudes, distinct differences were noted. For instance, in the northeast highlands broadnosed weevils seemed dominant, whereas in the Wisselmeren area cryptorrhynchine weevils appeared dominant. In the Chrysomelidae more Asiatic types seemed to be recognized in the Wisselmeren area. As comparing highland and lowland collecting, in general chrysomelids seemed to have greater variety at high altitudes and cerambycids to be much more numerous in species and individuals at lower altitudes. The latter is also true for phasmids and larger insects in many groups, including butterflies.

FIG. 10. View of east end of Paniai Lake, Wisselmeren, Netherlands New Guinea, from Duroto; *b*, adult *Eurycantha* stick insects, St. Pauls, Baining Mts., Gazelle Peninsula, New Britain.

Date of Publication of Volume 8, Number 1, of the Queensland Journal of Agricultural Science

D. Elmo Hardy

UNIVERSITY OF HAWAII
HONOLULU, HAWAII

(*Presented at the meeting of November 14, 1955*)

During the summer of 1952 the University of Hawaii library received number 1 of volume 8 of the Queensland Journal of Agricultural Science. The cover of this number bears the date March, 1951. One of the papers contained a description of a "new genus" of fruit fly, *Neozeugodacus* May, which is obviously the same as *Dacus* (*Hemizeugodacus*) Hardy, described in the April, 1951, number of Pacific Science (5(2):131). Because of the great discrepancy between the cover date and the date of receipt of this number, I suspected that the actual date of publication of this number of the Queensland Journal of Agricultural Science might be other than March, 1951. I have written to the editor of that journal, to the Officer in Charge for Information Service, Department of Agriculture and Stock, the Under Secretary of the Department of Agriculture and Stock and to the author of the article in question, and the only information received has been that there is no record of the date of publication and distribution of this number. I have also written several colleagues in Australia and have received information from several large libraries in that country and in England indicating that this number was not distributed until May, 1952. The records show that the Commonwealth Scientific and Industrial Research Organization main library and the Victorian Department of Agriculture library received their copies May 13, 1952. It was received at the University of Melbourne library May 14, 1952; at the British Museum (Natural History) library June 22, 1952; and by the Commonwealth Institute library in December, 1952. The librarian of the Entomology Department, British Museum (Natural History), wrote to the editor concerning the publication date and was informed that the date was not known.

I believe it is obvious that volume 8, number 1, of the Queensland Journal of Agricultural Science was not published until early May, 1952, and the names used in my paper, "The Krauss collection of Australian fruit flies (Tephritidae-Diptera)," have priority over those used by A. S. May in his "New genera and species of Dacinae from Queensland." Volume 5(2) of Pacific Science is dated "April 1951" on the cover and was distributed May 3, 1951, approximately one year earlier than the other journal.

The following synonymy is involved:

Dacus (*Hemizeugodacus*) Hardy, 1951, PAC. SCI. 5(2):131.

Neozeugodacus May, 1952, QUEENSLAND JOURN. AGR. SCI. 8(1):6. **New synonym.**

This again points out the importance of journals which carry taxonomic papers clearly indicating the date of distribution on each number. The International Commission on Zoological Nomenclature took action upon this problem at the Thirteenth International Congress of Zoology in Paris, 1948. Conclusion 56 (BULL. ZOOL. NOMEN. 4(7–9):170, 1950), recommends "that there should be added at some appropriate point in the Régles a Recommendation urging every editor or other person concerned with the publication of a book or serial concerned with zoology to take all necessary steps to ensure:—

"(a) that its exact date of publication (year, month, day) be clearly stated in every zoological work;

"(b) that, in the case of serials and separate works published in parts, each part shall bear its exact date of publication and that on the completion of the volume concerned there shall be added a statement giving the date on which each part was published and specifying its exact contents (both pages and plates)."

New Hawaiian Sciaridae (Diptera)[1]

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(*Presented at the meeting of November 14, 1955*)

The following descriptions of apparently new species of Sciaridae are taken from my manuscript monograph of this family. The complete study will appear in the first volume on the Diptera of Hawaii. Since this volume will not appear in print for two or more years it is perhaps best that these descriptions be published at this time so that the names will be available for use in the Insects of Micronesia study which is now underway. The drawings have all been prepared by Miss Marian S. Adachi.

Plastosciara (Cosmosciara) adrostylata, new species (figs. 1a–c)

This species, as well as *P. longicosta*, n. sp., would not fit Frey's (1948, Not. Ent. 27:46) concept of *Plastosciara* because of the more elongate spurs on the hind tibiae. It would run imperfectly in his key to *Spathobdella* Frey but that genus has the second palpal segment elongated. Both species differ from *P. flavibasis* Edwards, from Samoa, by having the eye bridge narrowed to a single row and then discontinuous on the top of the head for a distance equal to the length of two or three facets, not "three facets wide"; the thorax is brown, not "shining black"; the tibial spurs are longer than the tibial diameter, not "fully as long as . . ."; all abdominal sclerites brown, not first tergum yellow and two to four black; claspers of male with several spines at apex, not "with two bristly spines at tip," and wings 1.4–1.5 mm., not 2.0 mm. *P. adrostylata*, n. sp., and *longicosta*, n. sp., may be separated by the characters given in the description and figures below; the most striking characteristics are found in the male genitalia (see figs. 1b and 3d).

Male. Head: Antennae brown, the flagellar segments are quadrate in shape. The first segment of the palps is oval with four rather strong setae. The second is small, oval, with two apical setae; it is about one-fifth as long as the enlarged portion of the second. Eye bridge made up of two rows of facets over most of the front, narrowly interrupted in the middle.

Thorax: Brown, halteres with yellowish bases. Two moderately large setae plus some smaller hairs are on margin of scutellum. Dorsocentral and marginal setae well developed on mesonotum. Acrostichals lacking except for about a half dozen small hairs on anterior portion of mesonotum. Legs:

[1] Published with the approval of the Director of the University of Hawaii Agricultural Experiment Station as Technical Paper No. 360.

Largely yellow, tarsi and tibiae discolored with brown. Spurs of hind tibiae one-third to one-half longer than the diameter of the tibia. Hind tibiae about two and one-half times longer than the basitarsi. Wings: The costa extends approximately two-thirds the distance between tips of R_{4+5} and M_1; crossvein r-m bare. Vein R_1 is one-half to three-fourths longer than r-m and ends slightly beyond a level with tip of Cu_1 and at about apical four-fifths of vein M_{1+2}. M_{1+2} about one-third longer than M_2 (fig. 1a). $M_{3+4} + Cu_1$ about half as long as base of M.

Abdomen: Brown, covered with brown to black setae, the conjunctiva are pale. The ninth tergum is about as wide as long, is broadest at base and gradually tapered to a rounded apex; the setae are rather evenly distributed (fig. 1b). Genitalia: The ninth sternum is short and broad, the basistyli are nearly as broad as long (not counting apical lobe) and each is produced at apex into a moderately strong obtuse lobe extending about two-fifths the length of the clasper. Claspers very broad and short, about two-thirds as wide as long and with four short, stout, spines in a clump at the apex (fig. 1c).

Length: body 1.5–1.7 mm.; wings 1.4–1.5 mm.

Female. The females have not been associated with the males.

Holotype male and two male paratypes, Waikane, Oahu, September 4, 1927, ex dead *Xanthoxylum*, 2,200 ft., E. H. Bryan, Jr. One male specimen is on hand which seems to fit here but is aberrant, collected at the B. P. Bishop Museum, Honolulu, December 11, 1952, C. P. Hoyt.

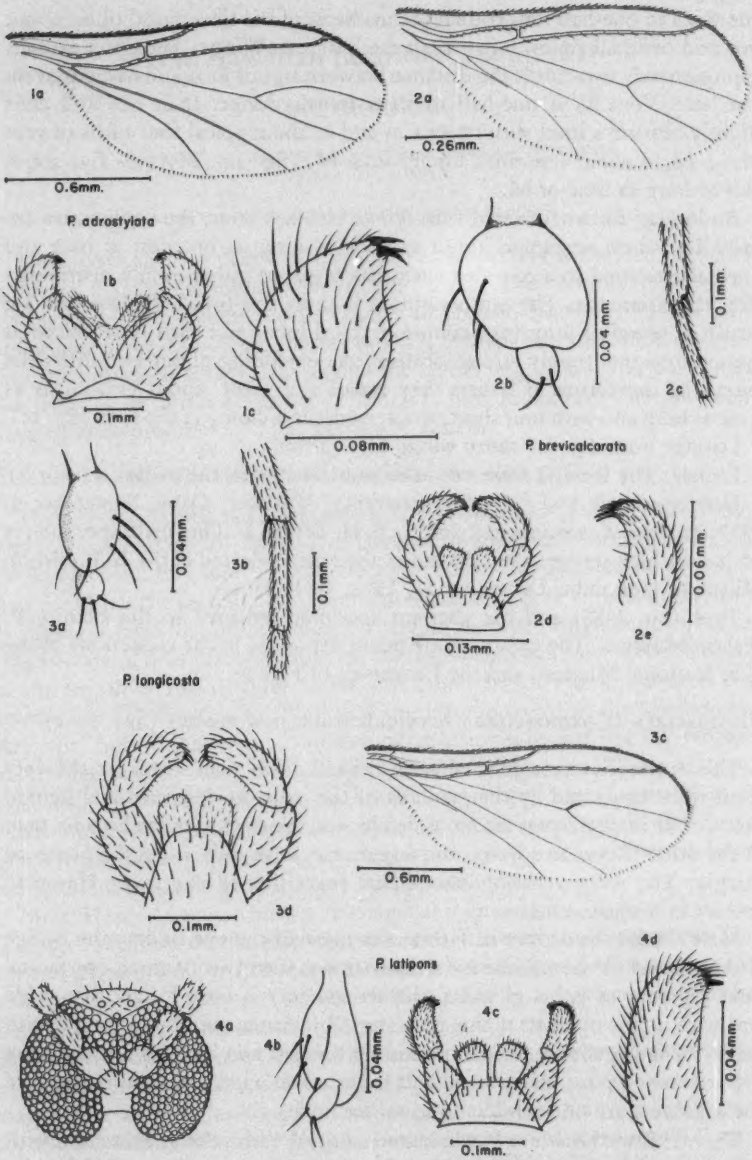
Type (no. 2483) and the aberrant specimen returned to the Bernice P. Bishop Museum. The paratypes are being deposited in the collections of the U.S. National Museum and the University of Hawaii.

Plastosciara (Cosmosciara) brevicalcarata, new species (figs. 2a–e)

This species is distinguished from other known *Cosmosciara* by the very short tibial spurs and by the genitalia of the male, as described and figured below. The male claspers are more slender and the tergum much broader than in the other Hawaiian species; the tergum has setae only along the posterior margin. The wing venation also differs from that of the other Hawaiian species as discussed below.

Male. Head: Two rows of facets over most of the eye bridge, the bridge is interrupted in the middle by a distance equal to two or three eye facets. First segment of palps globular, the second tiny, a little longer than wide and with a pair of setae at the apex (fig. 2b). Antennae brown tinged with yellow. The flagellar segments, excluding the first and last and not counting the attenuated portions, are one-half longer than wide; the narrow necks of the segments are one-third as long as the nodes.

Thorax: Dark brown to black, halteres tinged with yellow. Scutellum with a pair of rather strong marginal bristles. Dorsocentral and marginal bristles rather well developed on mesonotum, acrostichals lacking or very few. Legs:


1a
0.6mm.
2a
0.26mm.
P. adrostylata
1b
0.1mm
1c
0.08mm.
2b
0.04 mm.
2c
0.1mm.
P. brevicalcarata
3a
0.04mm.
3b
0.1mm.
2d
0.13mm.
2e
0.06 mm.
P. longicosta
3c
0.6mm.
0.1mm.
3d
P. latipons
4a
4b
0.04mm.
4c
0.1mm.
4d
0.04mm.

Largely yellow, tinged with brown on the tarsi and tibiae. The hind tibiae are two and one-half times longer than the basitarsi. The tibial spurs are not quite equal in length to the diameter of the tibia (fig. 2c). Wings: The costa extends about two-thirds the distance between tips of R_{4+5} and M_1. Vein R_1 ends slightly before a line drawn from the apex of Cu_1 and near the middle of M_{1+2}. R_1 about two times longer than r-m and the latter only half as long as the base of M. Crossvein r-m bare or with but one or two setae. M_{1+2} slightly longer than M_2. The base of M_{3+4} + Cu_1 very faint and about one-third as long as the base of M. The first anal vein appears to fuse with Cu_1 just before a point opposite the base of M_{1+2} (fig. 2a).

Abdomen: The sclerites are brown, the conjunctiva are yellow. Genitalia: Yellow-brown. The claspers are two and one-half times longer than wide, slightly curved on inner margin and with three to five closely placed subapical and apical spines, as in fig. 2e. The ninth tergum is one-half broader than long and has setae only on the posterior portion (fig. 2d).

Length: body, 1.3 mm.; wings, 1.1 mm.

Female: Flagellar segments about as long as wide, not counting the attenuated portions. Otherwise fitting the description of the male, except for genital characters.

Holotype male, Honolulu, Oahu, collected on window at B. P. Bishop Museum, Dec. 6, 1952, C. P. Hoyt. Allotype female, same data as type, April, 1952, A. Suehiro. Eight male and thirty female paratypes; OAHU: same data as type and allotype; Honolulu, on windows and at light, University of Hawaii campus, Dec., 1952, to Mar., 1954, D. E. Hardy, M. S. Adachi; Mt. Tantalus, Aug., 1952, D. E. Hardy; Kuliouou, Feb. 7, 1953, C. P. Hoyt. Also several dozen additional specimens are preserved in alcohol. Most of the specimens have been taken indoors.

Type (no. 2481), allotype and a series of paratypes are in the B. P. Bishop Museum. The remainder are being deposited in the following collections: U.S. National Museum, Hawaiian Sugar Planters' Association and the University of Hawaii.

Plastosciara (Cosmosciara) longicosta, new species (figs. 3a–d)

Differing from *P. adrostylata*, n. sp., by having the male claspers two times longer than wide, the apical spines stronger and not densely clumped. The ninth sternum is not so distinctly lobate on the hind margin and the other

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FIG. 1. *Plastosciara adrostylata*, n. sp. *a*, wing; *b*, male genitalia, ventral view; *c*, clasper of male.

FIG. 2. *Plastosciara brevicalcarata*, n. sp. *a*, palp of male; *b*, apex of hind tibia and basitarsus; *c*, wing; *d*, male genitalia, dorsal; *e*, male clasper.

FIG. 3. *Plastosciara longicosta*, n. sp. *a*, wing; *b*, palp of male; *c*, hind tibia and two basal tarsal segments; *d*, male genitalia, dorsal.

FIG. 4. *Plastosciara latipons*, n. sp. *a*, head of male; *b*, palp of male; *c*, male genitalia, dorsal; *d*, clasper of male.

structures of the genitalia are differently developed (fig. 3d). Also the costa extends about four-fifths the distance between the tips of R_{4+5} and M_1 rather than two-thirds the distance; the r-m crossvein is setose over most, or all, its length, rather than bare, and the flagellar segments of the antennae are longer than wide.

Male. Head: Antennae brown, tinged with yellow, the flagellar segments are about one-half longer than wide. The basal segment of each palp is oblong, a little over half again as long as wide. The second is about one-fourth as long as the swollen portion of the second and has three setae at apex (fig. 3a). The eye bridge contains two rows of facets and is interrupted on the front for a distance equal to two facets.

Thorax: Brown to black, sometimes tinged with rufous. Halteres with pale stems and dark knobs. Acrostichal setae present on anterior half of mesonotum. Legs: Largely yellow, tarsi and tibiae sometimes discolored with brown. Spurs of hind tibiae about one-half longer than the diameter of the tibia (fig. 3b). Hind basitarsi about two-fifths as long as the tibiae. Wings: Costa extending four-fifths the distance between the tips of R_{4+5} and M_1. R_1 one-half longer than r-m ending about opposite the apex of Cu_1 and at about the apical three-fourths of M_{1+2}. Crossvein r-m about equal to base of M. M_{3+4} + Cu_1 about half as long as M (fig. 3c).

Abdomen: The sclerites are brown covered with dark hairs, the conjunctiva are pale. The ninth tergum is about as long as wide and rather truncate at apex (fig. 3d). Genitalia: The claspers are two times longer than wide, blunt at apex and with two rather strong subapical spines and a row of strong setae along the ventral surface.

Length: body, 1.5 mm.; wings, 1.35 mm.

Female. Fitting the description of the male except that the sclerites of the abdomen are more yellow-brown, also the thorax is more distinctly yellow to rufous tinged.

Holotype male and allotype female, Halawa Ridge, Oahu, Nov. 24, 1952, ex moss, C. P. Hoyt. About 50 paratypes, predominantly females; OAHU: same data as type; Manoa Valley, Jan., 1955, ex rotting log, M. Adachi; Mt. Tantalus, reared from rotten wood, Aug., 1955, D. E. Hardy; Honolulu, on window and at light, Dec., 1952—May, 1955, D. E. Hardy; Mokuleia, Dec., 1952, C. P. Hoyt; Peahina (Peahinaia?), Jan. 17, 1953, C. P. Hoyt; and Pupukea trail, no date given, C. P. Hoyt. A series of thirteen females which apparently belong here are in the B. P. Bishop Museum from Alakai Swamp, Kauai, June, 1917, C. N. Forbes. They have the thorax and abdomen entirely rufous or yellow, with no dark markings. Also, one female from Puu Kukui, Maui, 4,500 ft., June, 1954, M. Tamashiro, seems to belong here; it has the facets in the eye bridge reduced, however, to one row. These specimens are not being designated as paratypes.

Type (no. 2482), allotype and a series of paratypes are in the B. P. Bishop Museum. Paratypes are being deposited in the following collections: U.S. National Museum; British Museum (Nat. Hist.); Hawaiian Sugar Planters' Association; University of Hawaii.

Plastosciara (Plastosciara) latipons, new species (figs. 4a–d)

This species differs from any of the known species of *Plastosciara* (*Plastosciara*) by having the male claspers three times longer than wide with no strong spines on inner margin.

Male. Head: Eye bridge made up of five rows of facets and occupying the entire area between the antennae and the lower ocellus (fig. 4a). The eyes are sparsely haired. Antennae brown, the nodes of the flagellar segments, except at base and apex, are one-third longer than wide. The first segment of the palp is oblong, the swollen portion is two times longer than wide and has three or four strong setae above. The second segment is less than one-fifth as long as the first and has three setae at its apex (fig. 4b).

Thorax: Entirely brown, tinged with yellow in the ground color. Halteres with pale stems and dark knobs. Dorsocentral and marginal setae strong on mesonotum, acrostichals lacking. Scutellum with two rather strong and several weak setae on hind margin. Legs: Chiefly yellow, tibiae and tarsi tinged with brown. Spurs of hind tibiae just slightly longer than the diameter of the tibia. Posterior basitarsi about two-fifths as long as the tibiae. Basitarsi of front and middle legs about one-third as long as the tibiae. Wings: Costa extending about two-thirds the distance to apex of M_1. Vein R_1 equal in length to r-m crossvein and also approximately equal to the base of M. The base of $M_{3+4} + Cu_1$ is about one-third as long as the base of M.

Abdomen: The sclerotized portions are dark brown, the conjunctiva pale. The sclerites are covered with short brown setae. The ninth tergum is nearly three times wider than long and most of the setae are located near the posterior margin (fig. 4c). Genitalia: The claspers are three times longer than wide, rather parallel-sided and have two (or possibly three) closely placed subapical spines plus numerous hairs (fig. 4d).

Length: body, 1.6 mm.; wings, 1.4 mm.

Female unknown.

Holotype male, taken in a light trap operated by the Hawaiian Sugar Planters' Association at Ewa, Oahu, April, 1955. Paratypes, three males, same data as type.

Type (no. 2484) in the B. P. Bishop Museum. The paratypes are distributed among the following collections: U.S. National Museum, Hawaiian Sugar Planters' Association, and the University of Hawaii.

Sciara (Leptosciara) hawaiiensis, new species (figs. 5a–c)

This species seems to be more closely related to *Sciara distigma* Edwards, from Fiji, than to any other *Sciara* known to me. That species differs, however, by having the mesonotum shining orange with a pair of oval, black, widely separated, spots at about the middle and by having the hairs on the thorax small and inconspicuous (this may be a *Sciara sens. str.*). In Edwards' key to the Oriental species *S. hawaiiensis* runs to *Phorodonta pubericornis* Edwards (JOURN. FED. MAL. STATES MUS. 14:20, 1928) but the claws are simple, not toothed, the male antennal segments are not covered with long pubescence and the constrictions between the segments are not unusually long. *Sciara dives* Johannsen, from California, and *S. vicina* Johannsen, from New York, are probably *Leptosciara*, but they are black species with very differently developed genitalia.

S. (*Leptosciara*) *hawaiiensis* is best differentiated by the predominantly rufous thorax, the elongate third palpal segment and by the genital characters.

Male. Head: Eyes black, sparsely haired. Occiput brown, face and area around antennal bases brownish yellow. Scape and pedicel bright yellow, flagellum brown to black; flagellar segments rather elongate, about three times longer than wide. Eye bridge containing four rows of facets. Palps yellow (fig. 5a), the third segment is long and slender, rather parallel-sided, at least five times longer than wide and two times longer than the second segment. The second is about two times longer than wide. The basal segment is swollen apically, constricted at base and has no sensory structure.

Thorax: Predominantly rufous (orange to yellow in some specimens), tinged with brown on the pleura, hind portion of mesonotum and disc of scutellum; these portions are also lightly gray pollinose. The coloration of the mesonotum may be variable; a series on hand from Kula Pipe Line, Maui, and Keanakolu, Hawaii, have it ranging in coloration from brownish red to dark brown, nearly black. They seem identical with typical specimens, however, in regard to structural details. Each pleuron usually has a distinct brown band extending across it longitudinally at level of upper third of sternopleura; the lower portion of the sternopleuron is yellow. Eight to ten pairs of dorsocentral bristles are developed, the hind pair is the strongest and is slightly larger than the postalar or supraalar bristles. There are also eight or more bristles in a row along the lateral margins of the mesonotum. The hind margin of the scutellum has six strong bristles. Legs: Largely yellow, with brown to yellow-brown tibiae and brown tarsi. The spurs are yellow, those of the hind legs are rather large and are approximately one-third as long as the basitarsi. The hind tibiae have a row of rather strong posterodorsal bristles on apical two-thirds. Wings: Vein R_1 ends near the middle of the front margin of the wing, well before a point opposite the forking of M_1 and 2. R_1 is approximately five times longer than R_{2+3}. Vein R_{4+5} ends at

a point about opposite the end of M_2 and the costa extends about two-thirds the distance between the tips of R_{4+5} and M_1. The stem of M_{1+2} is present but is very faint. Veins M_1, M_2, M_{3+4}, the apical part of M_{1+2} and the r-m crossvein are setose (fig. 5b).

Abdomen: Chiefly brown on the dorsum, yellow on the venter, the genitalia and on the hind margins of the terga, especially one to four. In some specimens the abdomen is largely dark brown to black on the dorsum. Genitalia: Largely yellow, claspers discolored with brown and sometimes a brownish tinge on the ninth segment. The ninth tergum is short, not much over half as long as the sternum. The claspers are slender, nearly parallel-sided, about three to four times longer than wide; each has two short apical spines, four rather strong subapical and two small spines on inner margin near apical third of the clasper (fig. 5c).

Length: body and wings, 1.8–2.2 mm.

Female: Very similar to the male, except for sexual characters. The mesonotum and scutellum tend to be paler in color, often entirely orange or yellow. The spurs of the hind tibiae are shorter, being about one-fourth as long as the basitarsi.

This is a rather common species in the mountains from 1,500 to 5,000 feet elevation and has been reared from rotting wood and *Freycinetia* (ieie) on several occasions. It is found at lower elevations (in light trap collections) but in fewer numbers than in the mountains.

Holotype male and allotype female, Mt. Tantalus, Oahu, reared from rotting wood, Nov., 1953, and Feb., 1953, D. E. Hardy. Paratypes, about 75 individuals (about 50 females and 25 males) from the following localities: OAHU: same as type; Maunawili, Feb., 1953, D. E. Hardy; Pupukea trail, 1,500 ft., Dec., 1952, D. E. Hardy; Manoa Valley, Apr., 1935; Waialae Iki, Mar. 21, 1920, E. H. Bryan, Jr.; Kuliouou Val., 1,500 ft., Feb. 7, 1953, C. P. Hoyt; Poamoho trail, May, 1943, 1,700 ft., D. E. Hardy; Palolo, Oct., 1918, O. H. Swezey; Mt. Kaala, Jan., 1922–Apr., 1952, O. H. Swezey, D. E. Hardy; and Pauoa Flats, Mar., 1935, O. H. Swezey. MAUI: Haleakala, Mar., 1932, O. Bryant; Kula Pipe Line, 4,500–5,000 ft., Mar.–Apr., 1932, O. Bryant; Makawao, June, 1952, at light, D. E. Hardy, M. Tamashiro; Puu Kukui, 3,000–4,500 ft., June, 1953, D. E. Hardy; Waihee, June, 1952, at light, D. E. Hardy, M. Tamashiro; Makamakaole Valley, June, 1952, and Paliku, Haleakala Crater, June, 1952, D. E. Hardy. KAUAI: Kawaikoi Stream, 3,700 ft., Aug., 1953, D. E. Hardy; Kalalau Lookout, 4,000 ft., Aug., 1953, D. E. Hardy; Halemanu swamp, Aug., 1953, D. E. Hardy; Hanalei Valley, July, 1952, D. E. Hardy; Nualolo Valley, July, 1953, 3,400 ft., D. E. Hardy and Awaawapuhi, June, 1922, E. H. Bryan, Jr. HAWAII: Pauahi, 4,300 ft., Aug., 1952, W. C. Mitchell and D. E. Hardy; Bird Park, Kilauea, July, 1953, D. E. Hardy; near Kawaina, Kona, 3,000 ft., July, 1953, D. E. Hardy; Upper Olaa rain forest, July, 1953, D. E. Hardy; Olaa flume road, July, 1953, D. E.

Hardy; Hawaii Nat. Park, Mar., 1954, R. Namba; Keanakolu, Hawaii, 7,000 ft., Oct. 29, 1952, C. P. Hoyt. MOLOKAI: Waialua Beach, July, 1952, M. Tamashiro; Kalae, Mar., 1954, R. Namba; and Kamiloloa, 3,200 ft., Dec. 20, 1925, E. H. Bryan, Jr. LANAI: Lanaihale, 3,200 ft., June 2, 1953, D. E. Hardy. I have numerous other specimens in alcohol from many localities on Oahu.

Type (no. 2491), allotype and a series of paratypes in the B. P. Bishop Museum. The remainder are being distributed among the following collections: U.S. National Museum, British Museum (Nat. Hist.), Hawaiian Sugar Planters' Association, and the University of Hawaii.

Sciara (Lycoriella) hoyti, new species (figs. 6a–c)

This species resembles *S. hardyi* Shaw but the palps are short and the male genitalia are very different, as shown in figure 6c and as discussed below. The females are difficult to separate from those of *S. prominens*, n. sp.; the most reliable characters for differentiating them seem to be the presence of a dense clump of sensory setae on the palps and the short costa and subcosta in *hoyti*. The costa extends just slightly beyond the middle of the distance between the tips of veins R_{4+5} and M_1 and Sc ends about opposite the forking of M_{3+4} and Cu_1, well before the base of the r-m crossvein. In *prominens* the costa extends about four-fifths the distance to M_1 and the subcosta is rather well developed and extends to the middle of crossvein r-m. Also in *hoyti* the wings are less dusky fumose and vein R_1 is shorter, about equal or but slightly longer than r-m crossvein, rather than one-half longer as in *prominens*.

Male. Head: Antennae entirely brown, the flagellar segments are two to three times longer than wide. Palps short, the first segment has a slightly depressed area containing a clump of a dozen or more short sensory setae in the middle of the dorsal surface (fig. 6a); the second segment nearly round; the third two times longer than wide but scarcely one-third to one-half longer than the second. Three rows of eye facets are present in the eye bridge.

Thorax: Entirely dark brown to black, halteres tinged with yellow. Legs: All yellow, except for brown discolorations on the coxae and tarsi. Spurs of hind tibiae about one-third longer than the width of the tibiae. Wings: Vein R_1 short just slightly longer than r-m crossvein (fig. 6b). Base of $M_{3+4} + Cu_1$ slightly less than one-half as long as base of M. Vein M_2 just slightly longer than M_{1+2}.

Abdomen: Entirely brown. Ninth sternum nearly two times wider than long. The tergum is rather quadrate in shape. Genitalia: claspers broad, about

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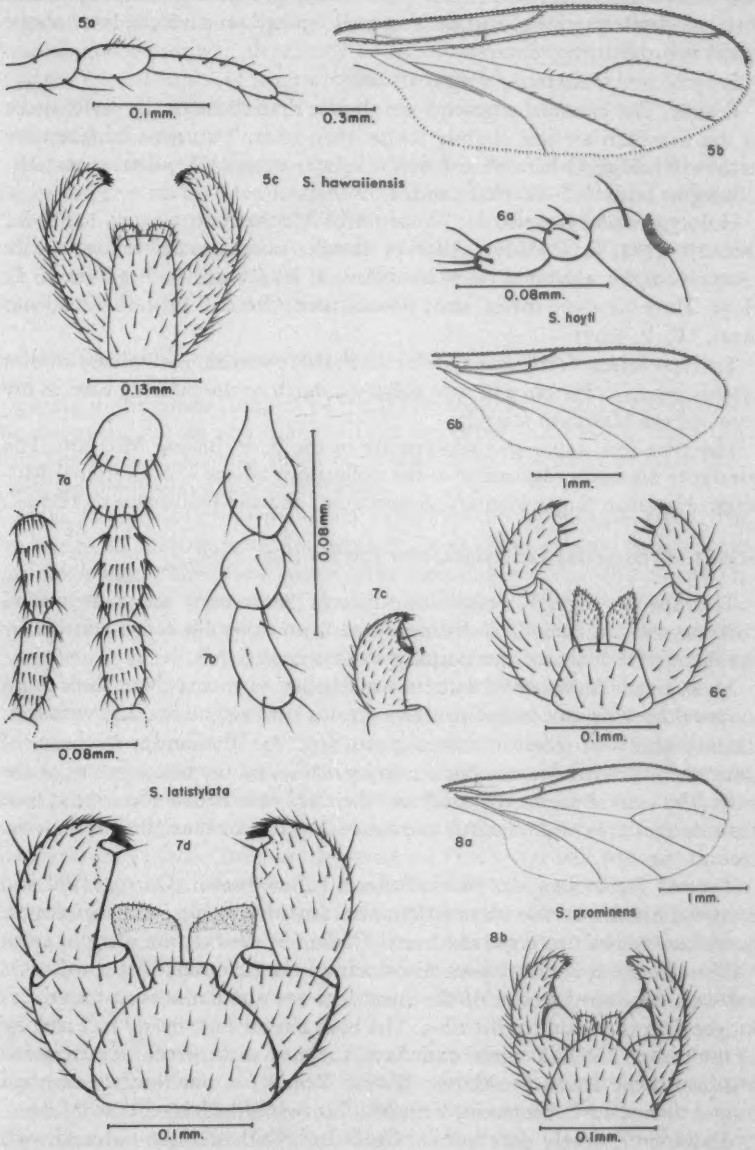
FIG. 5. *Sciara hawaiiensis*, n. sp. *a*, palp of male; *b*, wing; *c*, male genitalia, dorsal.

FIG. 6. *Sciara hoyti*, n. sp. *a*, palp of male; *b*, wing; *c*, male genitalia, dorsal.

FIG. 7. *Sciara latistylata*, n. sp. *a*, antenna of male; *b*, palp of male; *c*, clasper of male; *d*, male genitalia, dorsal.

FIG. 8. *Sciara prominens*, n. sp. *a*, wing; *b*, male genitalia, dorsal.


5a
0.1mm.
0.3mm.
5b
5c
S. hawaiiensis
0.13mm.
6a
0.08mm.
S. hoyti
6b
1mm.
7a
0.08mm.
7b
0.08mm.
7c
6c
0.1mm.
S. latistylata
7d
0.1mm.
8a
1mm.
S. prominens
8b
0.1mm.

two times longer than wide, with three closely grouped spines at apex and three moderately strong, distinctly spaced, spines on under side at about apical two-thirds (fig. 6c).

Length: body, 1.8 mm.; wings, 1.5 mm.

Female. The antennal segments are shorter than those of the male, those of the flagellum are just slightly longer than wide. Two rows of facets are in the eye bridge. Otherwise as described above except for genital characters.

Length: body, 1.7–2.0 mm.; wings, 1.5 mm.

Holotype male, Keanakolu, N. slopes of Mauna Kea, Hawaii, 5,200 ft., Oct. 29, 1952, C. P. Hoyt. Allotype female, same general area and date except at higher elevation on Mauna Kea, at Kaula Gulch, 7,000 ft., C. P. Hoyt. Three paratype males, same data as type, Oct. 28, 1952, "reared from moss," C. P. Hoyt.

This species has been named for Dr. C. P. Hoyt who did preliminary studies on this group in Hawaii and who collected much of the material used in my study of the Hawaiian sciarids.

The type (no. 2493) and allotype are in the B. P. Bishop Museum. The paratypes are being deposited in the collections of the U.S. National Museum, Hawaiian Sugar Planters' Association, and the University of Hawaii.

Sciara (Lycoriella) latistylata, new species (figs. 7a–d)

This species strongly resembles *S. hardyi* Shaw until the male genital characters are studied. It is distinguished from other Hawaiian sciarids by the distinctive shape of the clasping structures (fig. 7d).

Male. Head: Antennae all dark brown, flagellar segments about three times longer than wide, not including constrictions between nodes, and with four distinct whorls of setae on each segment (fig. 7a). Eye bridge made up of three or four rows of facets. No sensory structure on the first segment of the palp. The second segment is oval and the third is rather slender, about four times longer than wide and one and two-thirds to two times longer than the second (fig. 7b).

Thorax: Dark brown to black, halteres yellow-brown. Dorsocentral and marginal bristles on the mesonotum, also acrostichal hairs, well developed. Scutellum with six to eight moderately strong bristles on the margin. Legs: Yellow, except for some brown discoloration on the coxae. The tibial spurs are well developed, those of the hind legs are about one and two-thirds longer than the width of the tibia. The hind basitarsi are nearly half as long as the tibiae. The hind tibiae each have a row of short, erect, posterodorsal bristles on the apical two-thirds. Wings: Vein R_1 is one-third to one-half longer than the r-m crossvein. Vein M_{1+2} is two-fifths longer than M_2.

Abdomen: Entirely dark brown. Genitalia: Ninth sternum twice as wide as long. Claspers very broad, equal in width or slightly wider than the apices of the lobes of the sternum (basistyli). The inner surfaces are markedly

concave on the upper half and one strong spine arises from near the ventral edge of the concavity at the apical two-thirds of the clasper; there are also four or five rather well developed subapical spines present (fig. 7c). The claspers are also equal in length to the sternum (fig. 7d).

Length: body, 1.7–1.8 mm.; wings, 1.4–1.5 mm.

Female unknown.

Holotype male, Kuliouou, Oahu, 1,500 ft., Feb. 7, 1953, C. P. Hoyt. Paratypes, five males; Maunawili, Oahu, Feb., 1953, D. E. Hardy; and Ewa, Oahu, at light, April, 1955, J. W. Beardsley.

Type (no. 2490) returned to the B. P. Bishop Museum. Paratypes are in the following collections: U.S. National Museum, Hawaiian Sugar Planters' Association and the University of Hawaii.

Sciara (Lycoriella) prominens, new species (figs. 8a–b)

Fitting in the *hardyi* complex of species because of the dark coloration but the male genitalia are very different from any other *Sciara* in our fauna (fig. 8b). The females resemble those of *S. hoyti*, n. sp.; for differentiating characters see discussion under that species.

Male. Entirely dark brown to black except for the appendages. Head: The eye bridge contains three to four rows of facets. The palps are dark colored and rather short. The first segment lacks a sensory structure and is strongly attenuated at base. The second is oval, just slightly longer than wide. The third is two times longer than wide and one-half longer than the second. The antennae are all dark colored, the flagellar segments are about three times longer than wide, not including the constrictions between nodes.

Thorax: Dark brown to black on the dorsum, lighter brown on the sides. Halteres yellow-brown. Legs: Yellow, except for slight discolorations of brown on the coxae and tarsi. The spurs at the apices of the hind tibiae are almost two times longer than the width of the segment. Each hind tibia has a row of conspicuous erect, but short, setae on the apical two-thirds of the posterodorsal surface. The hind basitarsi are nearly one-half as long as the tibiae. Wings: Faintly brownish tinged. Vein R_1 one-half longer than the r-m crossvein. The fork of M_1 and 2 is situated in the outer two-thirds of the wing and the stem of these veins is distinct and two-thirds longer than M_2. Vein M_2 is just slightly curved at its base and is almost straight in line with M_{1+2}. The costa extends three-fourths to four-fifths the distance to M_1 (fig. 8a).

Abdomen: Entirely dark brown. Genitalia: Claspers about three times longer than wide and about equal in length to the ninth sternum; bearing a series of small spines along inner margin and at apex besides the large submedian spine (fig. 8b). The ninth tergum is gradually tapered and rounded at apex, it extends almost to apices of the basistyli (ninth sternum).

Length: body, 2.0 mm.; wings, 1.75–1.85 mm.

Female. The antennal segments are shorter than in the male and the eye bridge has just two rows of facets and are not completely joined in the middle of the vertex. The costa is slightly longer than in the male, extending four-fifths to five-sixths the distance to tip of M_1, and M_{1+2} is about equal in length to M_2.

Length: body, 2.2 mm.; wings, 2.4 mm.

Holotype male, Pupukea, Oahu, Dec. 27, 1952, C. P. Hoyt. Allotype female, Keanakolu trail, Hawaii, 4,500 ft., Oct. 28, 1952, C. P. Hoyt. Paratypes, six males, eighteen females; OAHU: same as type; Halawa trail, Dec. 10, 1952, C. P. Hoyt; Pupukea trail, no date, C. P. Hoyt; HAWAII: Keanakolu, Kaluakauka, 5,000 ft., Oct. 30, 1952, C. P. Hoyt; Keanakolu, Kaula Gulch, 7,000 ft., Oct. 29, 1952, C. P. Hoyt; Bird Park, Kilauea, July, 1953, D. E. Hardy; and Akaka Falls, Aug., 1952, D. E. Hardy. Also a series of females in alcohol from the type locality.

Type (no. 2492), allotype and nine paratypes in B. P. Bishop Museum. Paratypes deposited in the collections of the U.S. National Museum, the University of Hawaii and the Hawaiian Sugar Planters' Association.

Sciara (Lycoriella) solispina, new species (figs. 9a–c)

Fitting in the complex of species which have the body and antennae entirely dark brown to black. It differs from all of the known *Sciara* from Hawaii by the male claspers terminating in a single strong spine (fig. 9c).

Male. Head: Eyes bare, eye bridge narrowed to three rows of facets. Antennae entirely dark colored. The flagellar segments are approximately three times longer than wide; the attenuated portions are short, about one-sixth to one-seventh as long as the remainder of the segment. The palps are brown tinged with yellow; the basal segment has a large conspicuous sensory structure near the apex. This is rather raspberry-like in shape and has a clear oblong or oval spot in middle near apex. The third segment is rather short, slightly less than one-half longer than the second (fig. 9a).

Thorax: Entirely dark colored with no distinct vittae on the mesonotum. Scutellum with six to eight moderate sized setae on the margin. Dorsocentral and marginal hairs rather well developed on the mesonotum, also a few scattered acrostichal setae present. Legs: The spurs of the middle and hind tibiae are approximately equal in length; they are about one-third longer than the diameter of the tibia. The hind tibiae have a row of moderately strong, erect, posterodorsal setae. The hind basitarsi are slightly less than half as long as the tibiae. Wings: Vein R_1 just slightly longer than the r-m crossvein, the latter is bare. The costa is produced about three-fourths the distance to the tip of vein M_1. Vein M_{1+2} is approximately equal in length to vein M_2 (fig. 9b).

Abdomen: The ninth tergum is narrow, rather elongate, about two times longer than wide and with scattered setae on the apical half and on the sides.

Genitalia: The claspers are rather slender, the inner margin is straight; each terminates in a strong bristle and there are numerous rather strong setae along the ventral margin and around the apex (fig. 9c).

Length: body, 2 mm.; wings, 1.5 mm.

Female. Fitting the description of the male except for sexual characters and except that the antennal segments of the specimen at hand are about one and one-half times longer than wide and vein R_1 is one-third to one-half longer than r-m.

Length: body, 3 mm.; wings, 2.5 mm.

Holotype male, Kaula Gulch, north slopes of Mauna Kea, Hawaii, 7,000 ft., Oct., 1952, D. E. Hardy. Allotype female, Keanakolu, Hawaii, 5,000 ft., Oct., 1952, D. E. Hardy. One paratype male, same data as allotype, C. P. Hoyt.

Type (no. 2489) and allotype in B. P. Bishop Museum, paratype in collection at the University of Hawaii.

Sciara (Lycoriella) spatitergum, new species (figs. 10a–c)

This is the species which Shaw ("PROCEEDINGS," 14:492, fig. 4, 1952) figured as *S. laffooni* Shaw, "described from two males from light trap...in Honolulu." I have studied the type and the paratype and found these are both specimens of *S. garretti* Shaw (=*S. johannseni* Shaw *nec johannseni* Enderlein). They are mounted on paper points but the diagnostic characters are obvious, and I have made a slide mount of the paratype. Another male specimen was in the collection returned by Shaw; it consists of one wing and the abdomen mounted on a slide. This specimen was not designated as a paratype but is obviously the specimen figured by Shaw as *laffooni*. This is a good species but the name *laffooni* is not available for it since the type is a synonym.

This species resembles *S. garretti* Shaw in coloration and mesonotal markings. It is distinguished by the lack of a sensory structure on the first segment of the palps (fig. 10a), the all yellow lower half of pleura and by the shape and development of the genitalia (fig. 10c). It also closely resembles *S. radicum* Brunetti but the genitalia are very different.

The scape, pedicel and sometimes the basal segments of the flagellum are yellow, antennae otherwise brown. The third segment of the palp is about one-half longer than second (fig. 10a). The legs are yellow, the hind tibiae have a row of rather well developed short, erect, posterodorsal bristles on the apical two-thirds. Vein R_1 is about one-half longer than r-m. The base of M_{1+2} is faint and is approximately equal in length to M_2. The mesonotum is largely yellow, brown on the sides and sometimes on hind portion in front of scutellum and with a brown vitta down each dorsocentral area from anterior margin, nearly converging before scutellum, and a rather faint (often lacking) vitta down the middle of the mesonotum. The sternopleura, hypopleura, and metapleura are yellow, the remainder of the pleura are brown.

The genitalia are yellow and the very large tergum is readily visible *in situ*. Each dististyle has one apical and four subapical spines (fig. 10b) very much like *hardyi*, but the ninth tergum is broadly expanded and much greater developed (fig. 10c.).

Length: body and wings, 1.4–1.5 mm.

This has been bred from decaying plants of various kinds, including sugar cane and bananas. It is common at lights and has been collected on Oahu, Maui, and Hawaii.

Holotype male, Honolulu, Oahu at light, Oct., 1952, C. P. Hoyt. Allotype female, University of Hawaii campus, at light, May,1952, D. E. Hardy. About 75 paratypes, sexes about evenly distributed. Many from Honolulu taken from Feb., 1910, to Nov., 1955, some reared from rotting sugar cane, some from sweet potatoes and some from coffee grounds. OAHU: Hickam Field, at light, Mar., 1955; Ewa, at light, Apr.–May, 1953, J. W. Beardsley; Maunawili, Feb., 1953, D. E. Hardy; Waialua, at light, July, 1953; Manoa Valley, Nov., 1951, M. S. Adachi. MAUI: Waihee, at light, July, 1952, M. Tamashiro; Makamakaole Valley, June, 1953, D. E. Hardy; Keanae, July, 1953, D. E. Hardy. MOLOKAI: Puu Kolekole, July, 1953, D. E. Hardy and M. Tamashiro; Maunawainui Valley, July, 1953, D. E. Hardy. HAWAII: Kaiholena Ridge, July, 1952, 2,300 ft., D. E. Hardy; Honokaa, July, 1953, D. E. Hardy; Kahuku Ranch, 3,000 ft., July, 1953, D. E. Hardy; near Pawaina, Kona, 3,000 ft., July, 1953, D. E. Hardy; and Upper Hamakua Ditch trail, Kohala Mts., O. H. Swezey.

Type (no. 2486), allotype and a series of paratypes in the B. P. Bishop Museum. The remainder of the paratypes distributed in the following collections: U.S. National Museum, British Museum (Nat. Hist.), Hawaiian Sugar Planters' Association and the University of Hawaii.

Scatopsciara (Uddmaniella) nigrita, new species (figs. 11a–d)

A small dark brown to black species apparently related to *S. unicalcarata* Edwards, from New Zealand. It differs (as compared with the original description) by being smaller, body 1.7 mm. (not 3 mm.); the tibial spurs being longer, about one-half longer than the width of the tibiae (not "about half as long as tibial diameter"); the r-m crossvein being over two times longer than basal section of M (not "about as long") and veins M_1 and 2 divergent toward wing tip (not "straight and parallel"). In Frey's key to the species from Northern Europe (NOT. ENT. 27:69, 1948) it runs in the section with

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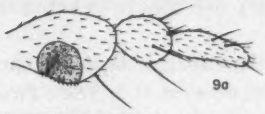
FIG. 9. *Sciara solispina*, n. sp. *a*. palp of male; *b*, wing; *c*, male genitalia, dorsal.

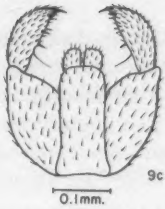
FIG. 10. *Sciara spatitergum*, n. sp. *a*, palp of male; *b*, clasper of male; *c*, male genitalia, dorsal.

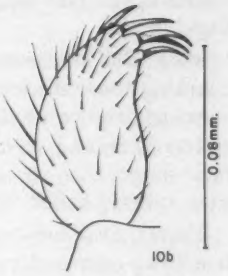
FIG. 11. *Scatopsciara nigrita*, n. sp. *a*, antenna of male; *b*, palp of male; *c*, wing; *d*, male genitalia, dorsal.

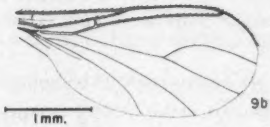
FIG. 12. *Scythropochroa magnisensoria*, n. sp. *a*, antenna of male; *b*, palp of male; *c*, wing; *d*, male genitalia, ventral.

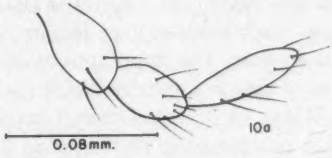


S. solispina

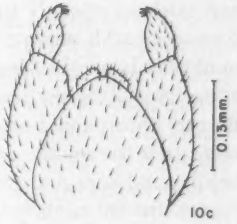


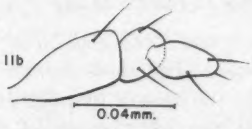




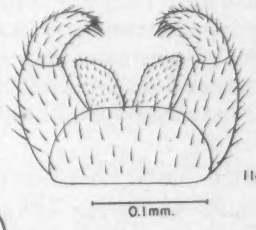


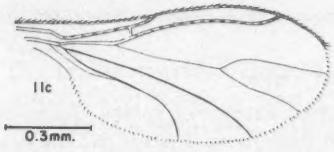
S. spatitergum

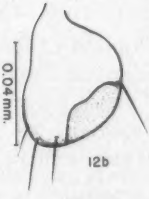


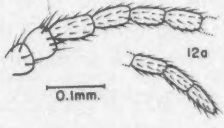


S. nigrita

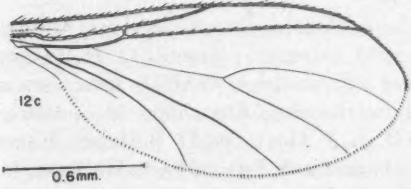








S. magnisensoria



S. calamophila Frey and *leucoptera* Frey but it is very different from either of these species.

Male. Head: Antennae entirely dark colored, the flagellar segments, not counting the constrictions, are one-half longer than wide (fig. 11a). First segment of palps nearly two times longer than wide and lacking a sensory structure. Second segment just slightly longer than wide and third just a little longer than second and about one-half longer than wide (fig. 11b). Eyes sparsely haired, eye bridge four facets wide.

Thorax: Dark brown to black, mesonotum with a narrow rufous to yellow line down each dorsocentral row. Halteres dark brown. Two strong bristles at apex of scutellum. Dorsocentral bristles well developed. Legs: The tibiae and tarsi are strongly tinged with brown to black and the hind femora are discolored with brown; the other segments are pale. The single spur of each hind tibia is one-half longer than the width of the tibia and the basitarsus is about two-fifths the length of the tibia. Wings (fig. 11c): Dusky fumose. R_1 very short, equal or slightly shorter than r-m crossvein and entering the costa near the middle of M_{1+2}. Crossvein r-m bare, or with but one or two bristles and approximately half as long as the basal section of M. Vein R_{4+5} curves upward slightly just before the apex. M_{1+2} is about equal in length to M_1 and the costa extends two-thirds the distance to the tip of M_1.

Abdomen: Dark brown to black. The ninth tergum is twice as broad as long, its posterior margin is gently convex. Genitalia: The ninth sternum is deeply concave on its hind margin, cleft nearly to the base of the segment. The claspers are two times longer than wide, are somewhat tapered at the apex and armed with one moderately strong apical and four or five subapical spines (fig. 11d).

Length: body, 1.6–1.7 mm.; wings, 1.3–1.4 mm.

Female: Fitting the description of the male except for genital characters and except that the eye bridge contains but three rows of facets and the base of M is two and one-half times longer than r-m. The allotype is slightly teneral and the thorax and abdomen are brown tinged with red, the humeral angles are yellow and a faint yellow vitta extends down each dorsocentral row.

Length: body, 2.0 mm. (measured to tip of extended abdomen); wings, 1.75 mm.

Holotype male, Palolo Valley, Oahu, Mar. 14, 1953, C. P. Hoyt. Allotype female, Honolulu, T. H., Apr. 7, 1925, ex rotten plumeria, O. H. Swezey. Twenty paratypes, five females and fifteen males; OAHU: same data as allotype and same locality; on window, Honolulu, Dec., 1954, M. S. Adachi; Maunawili, Jan.–Feb., 1953, 1,100 ft., C. P. Hoyt, and D. E. Hardy; Manoa Falls, Aug. 29, 1955, D. E. Hardy; Malamalama, Feb., 1919, E. H. Bryan, Jr.; Mokuleia, Kukuiala Val., Dec., 1952, C. P. Hoyt; Ewa, at light, Apr., 1955; Maunalani Ridge, Mar. 14, 1953, C. P. Hoyt; Mt. Tantalus, June, 1953,

D. E. Hardy; HAWAII: Hawaii National Park, Kilauea, June, 1953, D. E. Hardy.

Type (no. 2488), allotype and three paratypes returned to the B. P. Bishop Museum. The remainder are being deposited in the collections of the U.S. National Museum, the Hawaiian Sugar Planters' Association and the University of Hawaii.

Scythropochroa magnisensoria, new species (figs. 12a–d)

This species fits in the group of *Scythropochroa* which have the base of vein $M_{3+4} + Cu_1$ shorter than the base of M, rather than longer than as in the type, the Palaearctic species and *S. nitida* Edwards from New Zealand. It seems more closely allied to *S. samoana* Edwards than to any other species known to me. *S. samoana*, however, differs strikingly by being several times larger (body, 5.5 mm. rather than 1.5 mm.); being predominantly black colored, rather than rufous to brownish red; and the wing venation differs considerably. In *S. magnisensoria* vein R_1 is about half as long as R, not longer and ends well before the fork of M_{1+2}, not beyond fork; M_{1+2} is just slightly longer than M_2, not 1.5 times longer and R_{4+5} ends slightly before level of tip of M_2, not beyond.

Male. Head: The eye bridge is two facets wide over most of the vertex but is briefly interrupted on the upper portion by a space equal to the combined width of about three facets. Antennae yellow tinged with brown, the flagellar segments, not counting the short constrictions, are approximately two times longer than wide (fig. 12a). Each palp is short and thick, scarcely longer than wide, and with a very large sensory pit occupying nearly the entire apex (fig. 12b).

Thorax: Entirely rufous tinged lightly with brown. The halteres are yellow, discolored with brown at their apices. Legs: Yellow, tinged lightly with brown. The tibial spurs are yellow, their length is about equal to the diameter of the tibia. The posterior basitarsi are one-third as long as the tibiae. Wings: Slightly fumose. Vein R_1 one-half longer than r-m crossvein, the latter is devoid of bristles and is about three-fourths as long as the base of M. The costa extends about two-thirds the distance between the tips of R_{4+5} and M_1. The basal section of vein $M_{3+4} + Cu_1$ is scarcely over one-third as long as the base of M (fig. 12c).

Abdomen: Brownish yellow, the conjunctiva pale colored. The ninth tergum is short and broad, it is nearly twice as wide as long. Genitalia: The claspers are a little over twice as long as wide with four subapical spines and two spines near median surface below, besides a row of strong bristles around the apex (fig. 12d).

Length: body and wings, 1.3–1.5 mm.

Female. Much like the male, the facets in the eye bridge are somewhat more sparse, often narrowed to a single row just before the blank space on

the vertex and the flagellar segments are about one-half longer than wide.

Holotype male, Kuliouou Valley, Oahu, Feb. 7, 1953, 1,500 ft., C. P. Hoyt. Allotype female, Opaeula, Oahu, Jan., 1953, C. P. Hoyt. Paratypes, twelve males and eight females from the following localities: OAHU: same as allotype; Maunawili, Feb., 1953, D. E. Hardy: Peahina (Peahinaia ?), Jan. 17, 1953, C. P. Hoyt; Lanihuli, Feb. 18, 1920, E. H. Bryan, Jr.; MAUI: Puu Kukui, Apr., 1953, M. Tamashiro; Upper Hamakua Ditch trail, "on Lula palm" (loulu ?), Oct. 4, 1929, R. R. Whitten; MOLOKAI: Puu Alii, July, 1953, D. E. Hardy; HAWAII: Kahuku Ranch, 3,000 ft., July, 1953, D. E. Hardy; 29 mi. Olaa, July, 1922, W. M. Giffard; LANAI: Lanaihale, 3,200 ft., June 2, 1953, D. E. Hardy. Also a series of about sixty alcohol specimens of both sexes from the latter locality and same data as allotype; also one female each, on paper points, from Hookomo, Hawaii, Aug. 9, 1935, *Sophora*, R. L. Usinger and Kaula Gulch, Keanakolu, Hawaii, 7,000 ft., Oct. 29, 1952, C. P. Hoyt. The latter have not been designated as paratypes.

Type (no. 2485), allotype and eight paratypes in the B. P. Bishop Museum. The remainder are being distributed among the following collections: U.S. National Museum, Hawaiian Sugar Planters' Association and the University of Hawaii.

Notes on the Genus Eriotremex Benson (Hymenoptera: Siricidae)

T. MAA (MAA TSING-CHAO)

TAIPEI, TAIWAN (FORMOSA)

(Presented at the meeting of September 12, 1955)

The genus *Eriotremex* Benson belongs to the subfamily Tremicinae of the family Siricidae. It is known only from the Oriental Region, with records from Assam to New Guinea. This paper presents a revised key to the known females of the genus and adds one new species.

KEY TO THE FEMALES

The following synoptic key is revised from Benson (1943) and Maa (1949). *E. viridiceps* (Cameron), 1908, and *E. malayanus* Benson, 1943, are not included since both species are known only from the male sex and their generic position is rather doubtful. It may also be mentioned that among the species enumerated below, *E. foveopygus* Maa is possibly the opposite sex of *Tremex rugicollis* Westwood, 1874 (Luzon), and, as suggested by Benson (1943), *E. purpureipennis* (Westwood) may prove to be no more than a color form of *E. insignis* (F. Smith).

1. All pubescence yellow, so also being pronotum, tibiae and basitarsi (except at their apices), wings and at least 3 complete bands on dorsum of abdomen.....2

   Pubescence on lower face and underside black, and either black or silvery white elsewhere; pronotum black or red; legs piceous; wings hyaline and/or smoky; dorsum of abdomen with at most one complete yellow band.....3

2. Abdomen with yellow bands narrow on bases of terga II and III, broad on V; scutellum smooth and shining; precornal basin (disc on apical tergum) smooth and impunctate; frons with a short tooth above antennal fossa. Assam.....**flavicollis** (Cameron)

   Abdomen with yellow bands broad on bases of terga II and VIII and narrow on III and VII; scutellum mat, with dense, fine punctures as rest of mesonotum and profusely pubescent; precornal basin mat, with dense, coarse punctures; frons without tooth above antennal fossa. Taiwan; Indo-China.....**formosanus** (Matsumura)

3. Head and pronotum brownish red, without metallic lustre; precornal basin very coarsely, densely granulato-punctate, anteriorly strongly sloping downwards and posteriorly strongly convex and bearing a knife-like median keel. Philippines (Mindoro)....**pygaerus,** n. sp.

Head and pronotum black, more or less with bluish, greenish or purplish metallic lustre; precornal basin never with such a combination of characters....4

4. Pronotum with unevenly distributed punctation, and on either side of dorsal surface with a large, shining, scarcely punctate area; abdominal terga V to IX shining, thinly pubescent, almost impunctate; wings uniformly smoky....5

Pronotum dim, evenly covered with coarse warts and rugae, and on either side sometimes densely intermixed with minor punctures; sculpture on abdominal terga and color pattern of wings variable...6

5. Abdomen with pale markings on basal segments; sawsheath/ovipositor ratio 2.90–2.92; sawsheath about 3.6 times as long as cornus. Aru; New Guinea....**insignis** (F. Smith)

Abdomen without any pale markings. Malacca; N. Borneo.... ....**purpureipennis** (Westwood)

6. Wings uniformly smoky; apical abdominal terga shining, sparsely punctate; sawsheath/ovipositor ratio 3.20 or 3.40; precornal basin more or less pear-shaped, distinctly broadened behind middle, and scarcely broader than cornus at base....7

Wings at least with hind pair largely hyaline; abdomen dorsally dim all over, with fine punctures and microsculpture; sawsheath/ovipositor ratio 2.70; precornal basin roundish, slightly broadened before middle, and more than twice as broad as cornus at base. E. India....**smithi** (Cameron)

7. Precornal basin alutaceous, practically impunctate, scarcely pubescent, lacking anterolateral marginal groove; sawsheath about 3.2 times as long as cornus; antennae 13-segmented, and only about 1.7 times as long as breadth of head across eyes. Philippines (Negros)....**brevicornis** Maa

Precornal basin coarsely punctate, rather thickly pubescent, with antero-lateral marginal area very deeply and abruptly grooved; sawsheath only about 2.4 times as long as cornus; antennae 19–22 segmented, and about 2.1 times as long as breadth of head across eyes. Philippines (Negros, Samar)....**foveopygus** Maa

Eriotremex pygaerus, new species (fig. 1)

Female. Black, with vivid bluish iridescence; antennae piceous, with purplish lustre; head and pronotum bright brownish red. Wings smoky, with coppery iridescence; basal cells of fore pair and basal two-thirds of hind pair

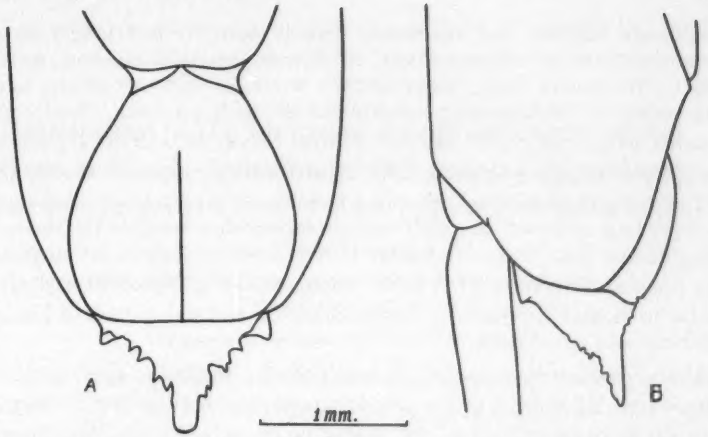


FIG. 1. *Eriotremex pygaerus*, n. sp. Female abdominal apex in dorsal (A) and lateral (B) aspects.

clear hyaline; veins brown. Hairs sparse, black, those on face brownish (some greyish-tipped), on dorsum of thorax and abdomen sometimes brownish or greyish-tipped.

Head with very deep, coarse punctures and a number of minute ones scattered on their interspaces. Clypeus and frons reticulato-punctate, the former discally slightly depressed, anteriorly slightly convexly curved; supraclypeal region poorly defined, trapezoid, more raised than clypeus. Area between supraclypeal region and anterior ocellus broadly depressed. Antennal grooves very sharply edged. Punctures on temples separated from one another by one to three times their diameter; those on vertex being of uneven size and uneven density, separated from one another by an average of 0.5–1.0 diameter; those on occiput sharply reticulated. Median furrow on vertex anteriorly irrecognizable, posteriorly poorly developed; submedian furrows (caudad to posterior ocelli) entirely irrecognizable. OOL:POL:ocello-occipital line about 26:40:90. Antennae 14-segmented, about 1.86 times as long as maximum breadth of head across eyes, with compressed flagella, broadest at segments V and VI; first 4 segments alutaceous, with a few coarse punctures, with long, recumbent setae mainly lying near apices, and with relative lengths about 55:20:36:54; segments V to XIV alutaceous, lacking coarse punctures and recumbent setae, but each with a row of stiff setae at apex; segment I with apical half practically parallel-sided, II five-sixths as long as broad, III one and two-ninths as long as broad, V to XIII each broader than long.

Pronotum dorsally with a few warts, with a rather large, unsculptured area at either side; median line about 1.9 times as long as POL, anteriorly slightly depressed; lateral portion of anterior margin abruptly edged; posterior margin distinctly incised at middle; posterior lobes strongly reflexed; lateral slopes

moderately coarsely and moderately densely punctate and longly setose. Mesonotum and scutellum coarsely, confluently granulato-punctate, median area of the former finely, longitudinally wrinkled, and that of the latter, transversely so. Mesepisterna coarsely but unevenly punctate, discally with a rather large, practically impunctate area; mesepimera densely punctate; metapleura reticulato-punctate. Cell 2r in fore wing scarcely shorter than half of 3r + ap when measured along vein M_{1+2} (submarginal). Femora III twice as long as broad; tibiae III scarcely shorter than basitarsi III, the latter being shorter than the last tarsomere (70:82); relative lengths of membranous pouches on venter of 4 basal tarsomeres 35:65:45:15. Tarsal claws similar to those in *E. formosanus*, but more slender and with sharper and longer sub-basal and apical teeth.

Abdomen dorsally alutaceous at base and very shining at apex; terga I-II impunctate, III and IV with a few punctures near their posterior margins, V to VII more extensively so, the punctation as a whole gradually becoming coarser, denser and deeper from III to VII, and suddenly becoming exceptionally coarse on VIII and IX, reticulato-punctate on IX. Abdominal sterna moderately punctate. Precornal basin a little longer than wide, anteriorly narrowed, deeply sloping downwards and minutely striated, discally strongly convex, roughly reticulato-punctate, and with a knife-like, sharply defined keel. Cornus dorsally spino-granulose. Cerci scarcely longer than thick. Sawsheath heavily rugoso-wrinkled on lateral surfaces (gradually weakly so towards the apex), with about 5–6 improminent spines along dorso-lateral margin. Ovipositor/forewing ratio 1.50, sawsheath/ovipositor ratio 3.79.

Length about 22 mm., fore wing 12 mm.

Mindoro, Santo Luis, Calapan, 150 ft., April 17, 1954, H., M. & D. Townes, 1 ♀, in Townes collection.

This species is very distinctive both in color pattern and in the structure of the precornal basin. Its nearest relative appears to be *E. foveopygus* Maa. Besides the characters given in the key, it is to be separated from the latter species by shorter antennae, thinner body-hairs, weaker sculpture on pronotum, stronger punctation on abdomen and different wing color. Furthermore, the membranous pouch on venter of basitarsus III in *foveopygus* is only 14:20 as long as that on 4th tarsomere, while in *formosanus* the ratio is 37:28.

For the privilege of studying and describing it, the writer is grateful to Dr. Henry Townes, now of North Carolina State College. The drawings were kindly made by Mr. K. S. Lin. The relative measurement used in the foregoing description is 100 units for 1 mm.

References

Benson, R. B. 1934. Studies in Siricidae, especially of Europe and southern Asia (Hymenoptera, Symphyta). Bull. Ent. Res. 34:27–50, figs. 1–17.

Maa, T. 1949. A synopsis of Asiatic Siricoidea with notes on certain exotic and fossil forms. (Hymenoptera, Symphyta). Notes Ent. chin. 13:11–189, figs. 1–235.

Descriptions of the Immature Stages and Notes on the Biology of Ithome concolorella (Chambers) (Lepidoptera: Cosmopterygidae), a Pest of Kiawe in the Hawaiian Islands[1]

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(*Presented at the meeting of December 12, 1955*)

The cosmopterygid moth *Ithome concolorella* (Chambers), probably a recent immigrant to Hawaii, has been known during the past few years to be a pest of the flowers of kiawe (*Prosopis chilensis* (Mol.) Stuntz) and klu (*Acacia farnesiana* (L.)). Kiawe is the most important source of honey in the Hawaiian Islands and, therefore, some beekeepers contend that this pest is responsible for the low honey production since 1953.

This insect now occurs throughout the Territory. It was reported at the June 8 and July 13, 1953 meetings of the Hawaiian Entomological Society (Notes and exhibitions, 1954) that specimens of *I. concolorella* had been taken on Kauai, Oahu, Maui, and Hawaii. It was collected on Molokai in September, 1955.

A review of the literature revealed that this species was first described and recorded from Texas by Chambers (1875). Little additional information is available about the species. Herein, descriptions of the immature stages of the insect and notes on its biology and damage to kiawe flowers are presented.

I am grateful to Dr. J. F. Gates Clarke, of the United States National Museum, for the identification of this species.

DESCRIPTION

Egg

Milky white when laid; somewhat spindle-shaped or cylindrical with ends rounded. Length about 0.33 mm.; width about 0.12 mm. at middle. External surface glabrous, shining.

Larva

Head brown, remainder of body white to pale yellow. Approximate measurements: first instar, head width 0.12 mm., body length 1.2 mm.; second instar, head width 0.20 mm., body length 1.25 mm.; third instar, head width 0.26 mm., body length 2.26 mm.; fourth instar, head width 0.45 mm., body length 4.13 mm.

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[1] Published with the approval of the Director of the Hawaii Agricultural Experiment Station as Technical Paper 369.

Head capsule: In broadest frontal aspect (fig. 1A), somewhat trapezoidal in general outline. Adfrontal suture (ADFS) meets longitudinal ridge (LR) near or at cervical triangle. Suture between front and clypeus indistinct. Frontal punctures (F^a) approximate, appear to be near dorsal margin of clypeus. Seta Adf^2 slightly ventrad to apex of front. Seta Adf^1 equidistant from Adf^2 and F^1. Puncture Adf^a equidistant from Adf^1 and Adf^2, closer to adfrontal ridge (ADFR) than Adf^1 or Adf^2. Puncture P^b medial to seta P^2, slightly dorsad to line between Adf^2 and P^2. In lateral aspect of head capsule (fig. 1B), seta A^2 slightly dorsad to line between A^1 and A^3, equidistant from A^1 and A^3. Puncture L^a in line with L^1 and A^3, L^1 equidistant from L^a and A^3. Puncture P^a in line with L^1 and P^2, closer to L^1 than to P^2. Puncture A^a in line with A^2 and P^1. Seta 0^1 ventrad to ocellus 2, about equidistant from ocelli 1 and 3; 0^2 caudo-ventrad to ocellus 1. Seta 0^3 equidistant from $S0^3$ and G^1. Puncture 0^a in line with $S0^3$ and 0^2, closer to 0^2 than to $S0^3$. Ocellus 4 closer to 5 than to 6.

Prothorax (fig. 1C): In lateral aspect with setae Ia, Ib, and Ic in almost vertical line; IIa and IIc cephalad to IIb, each about half or less the length of IIb; III, IV, and V directly cephalad to spiracle. Group VI bisetose; group VII with 5 setae. Seta VIII caudo-medial to front legs, near corresponding seta of the other side.

Mesothorax (fig. 1C) and metathorax: In lateral aspect with setae Ia, Ib, IIa, and IIb in vertical line; Ia and IIa each about half or less the length of Ib or IIb; IV equidistant from III and V, III and V shorter than IV. Group VI unisetose; group VII with five setae. Seta VIII as in prothorax, but not as close to corresponding seta of other side.

Abdomen (fig. 1, D, E): Crochets on prolegs of segments 3 to 6 uniordinal and arranged in complete circle, on anal proleg uniordinal and in transverse, semicircular band. Spiracle of segment 8 larger than that of other abdominal segments. In lateral aspect seta III dorsad and slightly caudad to spiracle on segments 1 to 7, dorsocephalad on segment 8. Setae IV and V ventrad to spiracle on segments 1 to 8. Group VI unisetose; group VII trisetose on segments 1 to 7, unisetose on segments 8 and 9. Seta VIII on segments 3 to 6 mediad to prolegs, closer to prolegs than to medial line.

Pupa

Almost white at first, turning brown soon after, and almost black when adult ready to emerge. In ventral aspect (fig. 1F), clypeus-labrum, maxilla, prothoracic and mesothoracic legs, antennae, and wings easily discernible. Wing tips extend almost to posterior margin of seventh segment. Antennae extend to tips of wings. Few scattered, short setae present on abdominal segments. Other parts of head, thorax, and separating sutures of abdominal segments 7 to 10 indistinct (fig. 1G).

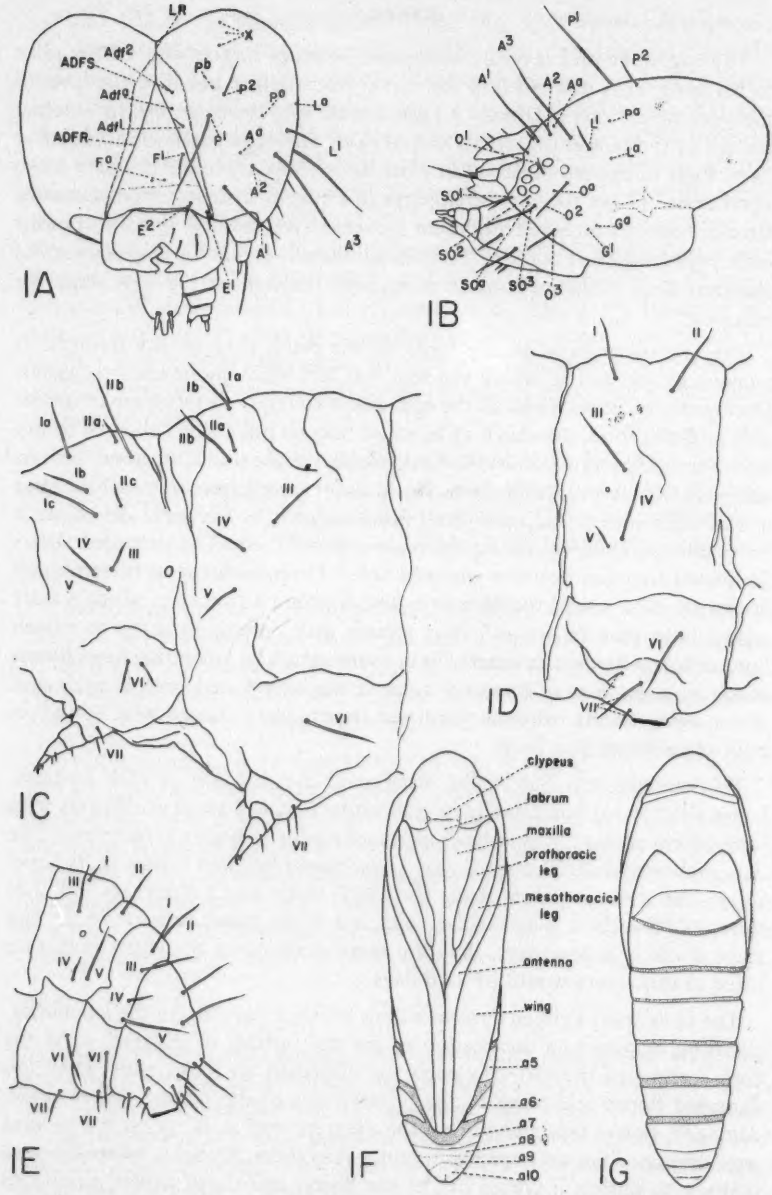
Biology

The egg when laid is milky white and becomes tinged with yellow prior to hatching. It is inserted into the flower bud slightly basad to the level of the apex of the calyx. Usually a light brown spot develops on the external surface of the bud at the site of oviposition. The eggs hatch in three to five days. Eggs in opened buds of klu when allowed to dry under ordinary room conditions did not hatch, whereas eggs in a similar situation, from the same female, kept in a moist environment (covered Syracuse dish lined with moist filter paper) hatched readily. It appeared, therefore, that an environment of relatively high moisture content is required throughout the egg stage for hatching.

The first instar larva usually feeds on the pistil, then on the stamens. It remains in the bud in which the egg was laid throughout the first instar. During this stage the larva, as the egg, seems to require a moist environment and/or moist food, inasmuch as larvae in opened buds when allowed to dry under ordinary room conditions died, whereas those under moist conditions survived. The second instar larva also usually remains in the initial bud but it may bore into an adjacent bud. Subsequently, as the larva develops, it bores into other florets, eating the inner parts of them. The damaged florets are joined together near the entrance holes. Often as many as fifteen kiawe florets are thus joined together in a row, forming a tunnel in which a fully grown larva may be found. Thus a larva may destroy as many as fifteen florets during its development. Upon examination of a few thousand florets of kiawe, eggs, first and second instar larvae were found only in buds and not in open florets, whereas third and fourth instar larvae were found in both open florets and buds.

To determine the number of instars and the duration of each stadium, larvae were reared individually in vials under ordinary room conditions with buds of klu as food. Kiawe buds were not readily available at that time. The data presented in table 1 show that *I. concolorella* has four instars in its larval stage. The mean duration of the first larval instar was 1.0 day; second, 2.0; third, 3.3; fourth, 4.3; and of the pupa, 8.0. If the mean duration of the egg stage is taken as four days, then the mean duration of the entire immature stage of this insect would be 22.6 days.

The larva spins a silken cocoon within which it pupates. In the laboratory, pupation occurred on the bottom of the vial outside of the buds or at the cork stopper of the vial. No pupa was observed on kiawe trees, although damaged florets still hung to the primary axis of the raceme. Many dried, damaged, flower heads of klu on the plant as well as those on the ground were examined but no pupa was found within them. Probably when the larva is ready to pupate it comes out of the florets and drops to the ground to pupate.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clypeus
labrum
maxilla
prothoracic leg
mesothoracic leg
antenna
wing
a5
a6
a7
a8
a9
a10
IF
IG

TABLE 1. Frequency of individuals in each instar with reference to duration.

NO. OF DAYS REQUIRED	INSTARS				
	1st	2nd	3rd	4th	Pupa
1	9	3			
2		3	7		
3		2	6	9	
4		1	6	20	
5			2	15	
6			1	5	1
7					16
8					31
9					13
10					3
Total no. indiv.	9	9	22	49	64
Mean duration (days)	1.0	2.0	3.3	4.3	8.0

The adult moth is usually nocturnal in its activities. They are attracted to light, and hundreds may be caught in light traps.

EXTENT OF DAMAGE

Samples of kiawe flowers from Oahu, Molokai, and Hawaii were examined to obtain an estimate of the larval damage. The data are presented in table 2.

The racemes examined varied in length from about 2½ to 5 inches and the number of florets from about 250 to 525 per raceme. Damaged florets occurred in all parts of the raceme and the number of damaged florets was not proportional to the total number of florets in a raceme. In some racemes, some florets had already fallen. These were considered as not damaged, inasmuch as observations have shown that damaged florets, although detached from the primary axis of the raceme, hung to the axis by means of silk. Damage counts were made after feeding had stopped. The number of damaged florets per raceme ranged from 2 to 282.

The damage is not presented as percentages since it was impractical to count the total number of florets in a raceme. Instead the index used is the number of damaged florets per inch of raceme. This was derived by obtaining the total number of damaged florets in the sample racemes of a station and dividing it by the total length of the racemes of the sample.

FIG. 1. *Ithome concolorella* (Chambers). A–E, larva: A, frontal aspect of head; B, lateral aspect of head; C, lateral aspect of prothorax and mesothorax; D, lateral aspect of third abdominal segment; E, lateral aspect of eighth, ninth, and tenth abdominal segments. F, G, pupa: F, ventral aspect; G, dorsal aspect.

TABLE 2. Damage to kiawe flowers by *I. concolorella*.

STATIONS	NO. OF RACEMES	AV. LENGTH OF RACEMES	AV. NO. OF DAMAGED FLORETS PER INCH OF RACEME	RANGE OF DAMAGED FLORETS PER INCH OF RACEME
Barber's Point, Oahu:				
1	25	3.30	23.0	0.7–48.7
2	25	3.90	26.0	6.2–50.7
3	12	4.00	39.9	12.4–70.5
4	12	3.58	30.7	21.0–50.8
5	9	3.19	26.5	7.1–46.7
E. Molokai	25	3.85	26.5	0.9–58.7
Kawaihae, Hawaii	5	3.45	6.9	1.9–12.0

The number of florets in a sample of 13 racemes from one locality (St. Louis Heights, Honolulu) was obtained, and it was found that there was an average of 100 florets per inch of raceme. If this average is used, the damage indices in table 2, columns four and five, can be read directly as percentages. This average may not be as reliable as desired; however, its use makes it possible to obtain a percentage estimate of the damage done by the larvae. Thus, the most heavily infested station shown in table 2 is Barber's Point (Oahu) 3 where about 40 per cent of the florets was damaged. Consequently 40 per cent of the florets was not available to the honeybees as a nectar source. The adult moth may possibly add to this nectar loss by consuming the nectar before the honeybees can collect it. However, although adults have been observed on the florets, it is not known whether they consumed the nectar or not.

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A Revision of the Balclutha Species Found in Hawaii, with Descriptions of Five New Species (Homoptera: Cicadellidae)[1]

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In recent years various students of Cicadellidae (Oman, 1949; Caldwell, 1952; Linnavuori, 1954) have expressed doubt as to the distinction between *Balclutha* Kirkaldy, 1900, and *Nesosteles* Kirkaldy, 1906. Evans (1947) and Zimmerman (1948) considered the two genera to be identical. I have examined both the type specimen of *Nesosteles hebe* Kirkaldy (type species of *Nesosteles*) and identified specimens of *Balclutha punctata* (Thunberg) (type species of *Balclutha*) from the U.S. National Museum. After consideration of these and the other species studied in this work, I concur with Evans and Zimmerman.

The name *Balclutha* was proposed by Kirkaldy in 1900 for *Gnathodus* Fieber, 1866, which was preoccupied. Six species, all endemic, have been described from Hawaii, five by Kirkaldy (1910) and one by Osborn (1935). Zimmerman (1948) recognized all six of the species and stated that there are more undescribed Hawaiian species of the genus.

In the present work eleven species are recognized, five of which are described as new. The types of six species (*B. hospes*, *B. volcanicola*, *B. timberlakei*, *B. kilaueae*, *B. peregrina*, *B. plutonis*), a total of about 1,100 specimens, and the genitalia of almost all of the males were examined. The genitalia of several females of each species were examined; however, as far as I can determine, they do not offer distinct differences useful for species identification.

The reader is referred to Zimmerman (1948) for characters distinguishing the Hawaiian *Balclutha* from the other Hawaiian cicadellids and for synonymies of the species.

In most of the Hawaiian *Balclutha* color is variable and cannot be used as a diagnostic character.

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Key to the Hawaiian Species of Balclutha

1. Ocellus less than its diameter from medial margin of eye; head in dorsal aspect broadly rounded anteriorly, fore and hind margins of crown parallel or sometimes length of crown along median line slightly less than length next to eye 2
   Ocellus more than its diameter away from medial margin of eye; head in dorsal aspect usually somewhat angulate anteriorly 3
2. Proboscis flattened laterally; clypellus with straight divergent lateral margins; body length usually more than 3.3 mm.. **hospes** (Kirkaldy)
   Proboscis cylindrical; clypellus with straight parallel or slightly concave lateral margins; body length usually less than 3.3 mm.. ..... **beardsleyi,** n. sp.
3. Head definitely wider than pronotum 4
   Head width equal to or less than that of pronotum 6
4. Length of crown along median line definitely less than half interocular distance; without conspicuous markings on head; body length 4.0 mm. or more ..... **grandis,** n. sp.
   Length of crown along median line equal to or greater than half interocular distance, or if less, then with conspicuous markings on clypeus and crown; body length less than 4.0 mm..... 5
5. Sutures on face blackened; clypeus with conspicuous grill; crown with reddish brown dot on hind margin midway between median line and medial margin of eye; length of crown along median line equal to or less than half interocular distance. **volcanicola** (Kirkaldy)
   Face and crown without conspicuous markings; length of crown along median line equal to or usually greater than half interocular distance ..... **timberlakei** (Osborn)
6. Ocellus located about midway between medial margin of eye and apex of crown; apex of clypellus extending conspicuously beyond lorum ventrally ..... **kilaueae** (Kirkaldy)
   Ocellus closer to medial margin of eye, at about one third or less the distance to apex of crown; apex of clypellus extending beyond lorum only slightly or not at all 7
7. Head definitely narrower than pronotum ..... **lobata,** n. sp.
   Head width equal to that of pronotum 8
8. Clypellus conspicuously wider than lorum (fig. 8C), with straight, nearly parallel lateral margins ..... **peregrina** (Kirkaldy)
   Clypellus width equal to or less than that of lorum, with straight or concave lateral margins 9

9. Length of crown along median line equal to or only slightly greater than length next to eye, about one third interocular distance; body length 3.3 mm. or more ..... **plutonis** (Kirkaldy)
Length of crown along median line greater than length next to eye, greater than one third interocular distance; body length 3.0 mm. or less 10
10. Aedeagal shaft relatively thick; in lateral aspect, the distance from top of basal apodeme to apex of shaft less than height of basal apodeme (fig. 10); length of crown along median line equal to or greater than half interocular distance ..... **phoxocephala**, n. sp.
Aedeagal shaft slender, long; in lateral aspect, the distance from top of basal apodeme to apex of shaft greater than height of basal apodeme (fig. 2A); length of crown along median line usually less than half interocular distance ..... **usitata**, n. sp.

Balclutha kilaueae (Kirkaldy)

The ocellus in this species is located about midway between the medial margin of the eye and the apex of the crown. In the other Hawaiian species the ocellus is located about one third the distance or less to the apex of the crown. This difference readily distinguishes this species from the other Hawaiian *Balclutha*.

Body length: ♂, 3.1–3.8 mm.; ♀, 3.6–4.2 mm.

Head yellow, greenish yellow, or ochraceous. Pronotum, scutellum, and forewings unicolorous, pale yellow, yellowish white, or greenish yellow. Maui and Molokai specimens sometimes blackened on pronotum, lateral corners of scutellum, along commissure, basal half of costal margin of forewings, apical cells, appendix, thorax, abdomen, hind legs, and face except for clypellus and lora.

Head usually narrower than pronotum, at most equal to width of pronotum. Crown in dorsal aspect angulate anteriorly, length along median line definitely greater than length next to eye. In Kauai and Oahu specimens length of crown along median line definitely greater than half interocular distance, in most Maui and Molokai specimens equal to half interocular distance. Clypellus width equal to or less than that of lorum, with apex extending conspicuously beyond lorum ventrally, with straight parallel or slightly concave lateral margins which converge markedly at apex giving a somewhat pointed appearance.

Pygofer of male in lateral aspect with caudal margin straight forming an obtuse angle with ventral margin. Style much longer than connective; connective shaft much shorter than connective arm; aedeagal shaft short, abruptly pointed at apex (figs. 1A and B). Seventh sternite of female with posterior margin straight.

Specimens examined: 67 ♂♂, 85 ♀♀. KAUAI.—Alakai Swamp, Halemanu Swamp, Summit Camp, Waialeale. OAHU.—Lanihuli, Olympus, Opaeula, Punaluu Val. MOLOKAI.—Puu Kolekole. MAUI.—Kula Pipe Line, Olinda, nr. Puu Luau, Puu Kukui. HAWAII.—Upper Olaa Forest.

Collected on: *Cibotium charmissoi* Kaulfuss, *C. menziesii* Hooker, ferns.

Balclutha usitata, new species

This species appears to be closely related to *B. phoxocephala*. The males can be separated easily by the structure of the aedeagus, which, in addition to the difference in the general shape, differs, when seen in lateral aspect, in the distance from the top of the basal apodeme to the apex of the shaft. In *B. usitata* the distance is greater than the height of the basal apodeme (fig. 2A), whereas in *B. phoxocephala* it is less (fig. 10). I can separate the females of this species from *B. phoxocephala* only when the length of the crown along the median line is less than half the interocular distance.

Body length: ♂ and ♀, 2.6–3.0 mm.

Body wholly greenish yellow or yellow.

Head width equal to that of pronotum. Crown in dorsal aspect rounded or slightly angulate anteriorly; length along median line equal to or greater than length next to eye, usually less than half interocular distance. Clypellus with slightly concave lateral margins, about as wide as lorum.

Pygofer of male in lateral aspect pointed at caudal margin. Style shorter than connective; ventral margin of aedeagal base in lateral aspect appears perpendicular to base of aedeagal shaft; shaft acuminate (fig. 2 A and B). Seventh sternite of female with posterior margin straight.

Holotype ♂ and allotype ♀: Kainamanu, Kauai, July, 1952, 3,800 ft., D. E. Hardy. Both specimens (No. 2503) deposited in the collection of the Bernice P. Bishop Museum, Honolulu, Hawaii.

Paratypes 22 ♂♂, 26 ♀♀: KAUAI.—1 ♀, Alakai Swamp, July 10, 1928, A. M. Adamson; 3♂♂, 4♀♀, Kainamanu, July, 1952, 3,800 ft., D. E. Hardy; 1 ♂, Kaunuohu Ridge, Aug., 1953, 4,000 ft., D. E. Hardy; 1 ♂, Kokee, July, 1952, D. E. Hardy; 1 ♀, Poomau Val., July, 1952, 3,400 ft., D. E. Hardy. OAHU.—1 ♂, Mt. Kaala, July 22, 1917; 3♂♂ (two on same pin), Kaala Mts., O. H. Swezey; 1 ♂, 1 ♀, W. side Mt. Kaala, June 1, 1919, O. H. Swezey; 1 ♂, 3 ♀♀ (1 ♂, 1 ♀ on same pin; 2 ♀♀ on same pin), Palikea, June 30, 1935, O. H. Swezey; 1 ♀, Waipio, May 19, 1922, Timberlake. MAUI.—1 ♂, 5 ♀♀, Haleakala, Aug. 25, 1918, O. H. Swezey; 3 ♂♂, 5 ♀♀, Haleakala, June 15, 1927, 6,000 ft., O. H. Swezey; 4 ♂♂, 2 ♀♀, Wailuku, Dec. 9, 1922, 1,500 ft., O. H. Swezey. HAWAII.—2 ♂♂ (on same pin), 1 ♀, Kilauea, Mauna Loa trail, July 4, 1934, O. H. Swezey; 1 ♂, 1 ♀, Alae, Kona, Nov., 1950, N. L. H. Krauss; 2 ♀♀, Kilauea, Dec., 1950, N. L. H. Krauss; 1 ♂, Kohala Mts., May 24, 1917, O. H. Swezey. Paratypes deposited in the collections of the Bernice P. Bishop Museum, Hawaiian

Sugar Planters' Association Experiment Station, Hawaii Agricultural Experiment Station, U.S. National Museum, and Board of Agriculture and Forestry.

Collected on: *Cyathodes*, grass.

Balclutha plutonis (Kirkaldy)

This species appears to be closely related to *B. peregrina*, from which it can be separated by the concave lateral margins and narrower width of its clypellus.

Head, pronotum, and scutellum yellow, forewings yellowish white; some specimens with very faint greenish tinge throughout.

Head width equal to that of pronotum. Crown in dorsal aspect usually rounded anteriorly, in some specimens slightly angulate; length along median line equal to or slightly greater than length next to eye, definitely less than half interocular distance. Clypellus with concave lateral margins, about as wide as lorum.

Pygofer of male in lateral aspect with somewhat pointed caudal margin. Style length equal to or usually less than that of connective; apical lobe of style not as large as in *B. peregrina;* aedeagal shaft slender, uniformly curved, long, acuminate (fig. 3). Seventh sternite of female with posterior margin straight.

Specimens examined: 57 ♂♂, 176 ♀♀. MAUI.—Haleakala Crater (Paliku, Holua, West Rim), Halemanu (Halemauu ?) trail, Kula Pipe Line, nr. Puu Luau, nr. Puu Nianiau, Ukulele. HAWAII.—Hualalai, nr. Humuula, Kilauea (Napau trail, Mauna Loa trail, Lumber Camp), Nauhi Gulch, Kalepa, Puu Kihi (Kihe ?), Olaa, Upper Olaa Forest, Upper Waiakea Forest Res.

Collected on: *Argyroxiphium virescens* Hillebrand, *Coprosma*, *Cyathodes*, *Deschampsia*, *Eragrostis*(?), *Sophora*, *Vincentia*, grasses and low herbage.

Balclutha grandis, new species

The large size of this species easily distinguishes it from the other Hawaiian *Balclutha*.

Body length: ♂, 4.5 mm.; ♀, 5.3 mm.

Body wholly greenish yellow.

Head definitely wider than pronotum. Crown in dorsal aspect in male rounded anteriorly, in female angulate; length along median line greater than length next to eye, definitely less than half interocular distance. Clypellus with divergent lateral margins; width at base equal to that of lorum.

Pygofer of male rounded at caudal margin. Style shorter than connective; connective shaft, in dorsal aspect, very broad; aedeagal base with no dorsal apodeme; aedeagal shaft with base very broad, acuminate (fig. 4 A and B). Seventh sternite of female with small notch at middle of posterior margin.

Holotype ♂ and allotype ♀: Alakai Swamp, August, 1953, 4,000 ft., D. E. Hardy. Holotype (No. 2504) deposited in the Bernice P. Bishop Museum

collection and the allotype in the Hawaii Agricultural Experiment Station collection.

Balclutha lobata, new species

The enlarged preapical lobe of the style is a conspicuous diagnostic character for the male. For the female the narrower head in relation to the width of the pronotum and the median pointed lobe on the posterior margin of the seventh sternite are diagnostic.

Body length: ♂, 3.2–3.5 mm.; ♀, 3.3–3.7 mm.

Head, pronotum, and scutellum yellow, forewings pale green; in some specimens pronotum with greenish tinge. In most specimens forewings with apical cells and appendix faintly fuscous.

Head narrower than pronotum. Crown in dorsal aspect rounded or slightly angulate anteriorly; length along median line equal to or greater than length next to eye, equal to or less than half interocular distance. Clypellus with straight or slightly concave lateral margins, width equal to that of lorum.

Pygofer of male with broadly rounded caudal margin. Length of style equal to that of connective; preapical lobe of style conspicuously enlarged; aedeagal shaft relatively slender with slight curve, acuminate (fig. 5 A, B). Seventh sternite of female with pointed lobe at middle of posterior margin, the area cephalad to this lobe brown (fig. 5C).

Holotype ♂: Kokee, Kauai, July, 1952, 3,600 ft., D. E. Hardy.

Allotype ♀: Kainamanu, Kauai, July, 1952, 3,800 ft., D. E. Hardy. Both specimens (No. 2505) deposited in the collection of the Bernice P. Bishop Museum.

Paratypes 13 ♂♂, 23 ♀♀: KAUAI.—1 ♂, Alakai Swamp, July, 1952, 3,800 ft., D. E. Hardy; 3 ♀♀, Alakai Swamp, August, 1952, 4,000 ft., D. E. Hardy; 1 ♂, 1 ♀, Kokee, July, 1952, 3,600 ft., D. E. Hardy; 1 ♀, Mohihi River, August, 1953, 3,500 ft., D. E. Hardy. OAHU.—1 ♂, 1 ♀, Kaala Mts., O. H. Swezey; 1 ♀, Kaumuohona (Kaukonahua?), June 4, 1916, O. H. Swezey; 4 ♂♂, 5 ♀♀, SE Koolau Mts., June, 1917, J. C. Bridwell; 4 ♂♂, 2 ♀♀, SE Koolau Mts., Konahuanui, June 17, 1917, J. C. Bridwell. MAUI.—4 ♀♀, Haipuaena, June 29, 1920, E. H. Bryan, Jr.; 1 ♀, Iao Valley, May 18, 1918, D. T. Fullaway; 1 ♀, Wailua, July, 1953, D. E. Hardy; 1 ♀, Paliku, Haleakala Crater, June, 1952, M. Tamashiro. HAWAII.—2 ♂♂, 2 ♀♀, Nauhi Gulch, Oct. 1, 1931, 5,000–6,000 ft., Swezey and Williams. Paratypes deposited in the collections of the Bernice P. Bishop Museum, Hawaiian Sugar Planters' Association Experiment Station, Hawaii Agricultural Experiment Station, U.S. National Museum and Board of Agriculture and Forestry.

Collected on: *Cyathodes*, "on native grass."

Balclutha hospes (Kirkaldy)

This species in general appearance closely resembles *B. beardsleyi*. However, the male pygofer, the structure of the male genitalia, proboscis, and the seventh sternite of the female differ markedly from those of *B. beardsleyi*.

Body length: ♂, 3.1–3.8 mm.; ♀, 3.3–4.1 mm.

Head, pronotum, and scutellum pale yellow to yellowish green; forewings nearly hyaline, in some specimens infuscated.

Head width equal to or greater than that of pronotum. Crown in dorsal aspect rounded anteriorly, anterior and posterior margins parallel or in some specimens closer to each other at middle of crown than at sides; length along median line much less than half interocular distance. Ocellus less than its diameter to medial margin of eye. Clypellus with width equal to that of lorum, with straight divergent lateral margins. Proboscis laterally compressed.

Pygofer of male with spinelike process at ventro-posterior corner. Aedeagal base like flattened plate, with strong spine ventrad to shaft on each side near lateral margins and ventrally a more medianly placed 3-spined ridge on each side of median line; aedeagal shaft short, strongly curved (fig. 6A). Seventh sternite of female with posterior margin slightly produced at middle, brown on posterior portion of disc (fig. 6B).

Specimens examined: 151 ♂♂, 129 ♀♀. KAUAI.—Awaawapuhi, Ahukini, Eleele, Honopu, Kalalau, Kealia, Kekaha, Mana. OAHU.—Cooke trail, Diamond Head, Ewa coral plain, U. of Hawaii campus, Honolulu, Honouliuli, Kahala, nr. Kahana, Kaimuki, Koko Head, SE. Koolau Mts. (Pauoa Flat, Konohuanui), Lanihuli, Makua, Manoa Valley, Olympus, Palolo Valley, Red Hill, Wahiawa, Waialua, Waiawa. LANAI.—No collection data. MOLOKAI.—Kawela. MAUI.—Haiku, Kipahulu, Lahaina, Lupe (Lupi?) Ditch, Waihee Val. HAWAII.—Akaka, Hilo, Kahuku Ranch, Kailua, Kau, Kilauea (Crater Road), Kona, Naalehu, Olaa, Pahala.

Collected on: *Chloris radiata* Swartz, *Panicum purpurascens* Raddi, coarse grass, ferns, Hilo grass.

I have seen several specimens of this species parasitized by a dryinid wasp. The larval sac of the parasite is located on the pleural aspect of the prothorax immediately caudad to the head.

Balclutha volcanicola (Kirkaldy)

The markings on the head and the structure of the male genitalia readily distinguish this species from the other Hawaiian *Balclutha*.

Body length: ♂ and ♀, 2.5–2.8 mm.

Head yellow with sutures on face blackened, clypeus with conspicuous brown grill, crown with reddish brown dot on hind margin midway between median line and medial margin of eye. Pronotum and scutellum yellow with light brown markings. Forewings pale yellow. In some specimens whole body with reddish tinge.

Head definitely wider than pronotum. Crown in dorsal aspect angulate or rounded anteriorly; length along median line greater than length next to eye, equal to or less than half interocular distance. Clypellus width equal to or greater than that of lorum, with straight parallel margins.

Pygofer of male broadly rounded at caudal margin. Style length equal to that of connective; aedeagal shaft thicker than in other Hawaiian *Balclutha*, uniformly thick to apex where it becomes abruptly pointed, with slight curve (fig. 7). Seventh sternite of female with posterior margin straight.

Specimens examined: 33 ♂♂, 29 ♀♀. MOLOKAI.—Kawela. HAWAII. —Honaunau, Kealakekua, Kilauea (Crater Road, Napau trail), Kohala Mts., Olaa.

Collected on: *Cyperus*.

Balclutha peregrina (Kirkaldy)

This species can be separated from the other Hawaiian *Balclutha* by the large clypellus.

Body length: ♂, 2.9–3.3 mm.; ♀, 2.7–4.0 mm.

Body wholly greenish yellow to yellow.

Head width equal to that of pronotum. Crown in dorsal aspect rounded or angulate anteriorly; length along median line definitely greater than length next to eye, less than half interocular distance. Clypellus with straight parallel margins, definitely wider than lorum (fig. 8C).

Pygofer of male with caudal margin rounded. Style length equal to or greater than that of connective; apical lobe of style larger and not as curved as in *B. plutonis;* aedeagal shaft acuminate, shorter than that of *B. plutonis* (fig. 8 A, B). Seventh sternite of female with posterior margin straight.

Specimens examined: 67 ♂♂, 60 ♀♀. MAUI.—Haleakala, Halemanu (Halemauu ?) trail, Kula Pipe Line, nr. Puu Nianiau. HAWAII.—Kahiawai, Kilauea (Kau Desert, Halemaumau Rd.), nr. Kilaueaiki (Kilauea Iki Crater ?), Nauhi Gulch, Olaa, Upper Waiakea Forest Res.

Collected on: *Cyathodes, Deschampsia, Railliardia.*

Balclutha timberlakei (Osborn)

The width of the head in relation to the pronotum, the length of the crown along the median line, and the structure of the male genitalia distinguish this species from the other Hawaiian *Balclutha.*

Body length: ♂, 2.8–3.5 mm.; ♀, 2.8–3.8 mm.

Head, pronotum, and scutellum yellow, forewings pale yellow. Head definitely wider than pronotum. Crown in dorsal aspect rounded or angulate anteriorly; length along median line definitely greater than length next to eye, equal to or usually greater than half interocular distance. Clypellus with straight parallel or slightly concave lateral margins, width equal to that of lorum.

Pygofer of male with caudal margin pointed. Style shorter than connective; aedeagal shaft in lateral aspect with slight crook before apex (fig. 9 A, B). Seventh sternite of female with posterior margin straight.

Specimens examined: 42 ♂♂, 83 ♀♀. OAHU.—Mt. Kaala, Kalihi, Kaneohe, Kolekole Pass, Koko Head, Kuliouou, Lanihuli, Manoa, Maunalua, Nuuanu Pali, Palolo Val., Pauoa Flats, Puu Kaua, Rooke Val., Tantalus, Waianae Mts., Waimalu, Waimanalo. LANAI.—No collection data. MOLOKAI.—Kamoku. MAUI.—Iao Valley. HAWAII.—Parker Ranch, Waikii.

Collected on: *Eragrostis variabilis* (Gaudichaud) Stendel, grass, pili grass.

I have seen several specimens of this species with larval sacs of a dryinid parasite attached to the abdomen.

Balclutha phoxocephala, new species

This species appears to be closely related to *B. volcanicola* and *B. usitata*, from which it can be separated by the structure of the male genitalia and the absence of conspicuous markings on the head.

Body length: ♂, 2.5–2.7 mm.; ♀, 2.7–2.9 mm.

Body wholly greenish yellow or yellow.

Head width equal to or slightly greater than that of pronotum. Crown in dorsal aspect angulate anteriorly; length along median line slightly greater than length next to eye, usually equal to half interocular distance. Clypellus with slightly concave lateral margins; width equal to that of lorum.

Pygofer of male with caudal margin somewhat pointed. Style shorter than connective; aedeagal shaft in lateral aspect curved more than in *B. volcanicola* but not as thick as in *B. volcanicola* (fig. 10). Seventh sternite of female with posterior margin straight.

Holotype ♂ and allotype ♀: Nualolo, Kauai, Aug. 16, 1925, O. H. Swezey, *Cyathodes*. Both specimens (No. 2506) deposited in the collection of Bernice P. Bishop Museum, Honolulu, Hawaii.

Paratypes 19 ♂♂, 16 ♀♀: KAUAI.—6 ♂♂, 6 ♀♀, Kokee, Aug. 19, 1921, O. H. Swezey; 1 ♂, 1 ♀, Miloli, July 2, 1932, O. H. Swezey; 3 ♂♂, 1 ♀, Nualolo, Aug. 16, 1925, O. H. Swezey; 1 ♂, Kainamanu, July, 1952, 3,800 ft., D. E. Hardy; 1 ♂, Halemanu, Mar. 9, 1928, O. H. Swezey; 1 ♂, Olokele Canyon, Sept. 5, 1924, O. H. Swezey; 1 ♀, Kumuwela, June 19, 1932, O. H. Swezey; 1 ♂, 3 ♀♀, Halemanu, June 8, 1919, H. T. Osborn. OAHU.—1 ♂, Diamond Hd., March 25, 1917; 2 ♂♂, 1 ♀, March 25, 1917, W. M. Giffard; 1 ♂, 1 ♀, Diamond Hd., Nov. 24, 1918, W. M. Giffard; 2 ♀♀, Diamond Hd., 0 ft., Feb. 18, 1917, W. M. Giffard. MOLOKAI.—1 ♂, Kamoku, July 15, 1910, D. T. Fullaway. Paratypes deposited in the collections of the Bernice P. Bishop Museum, Hawaiian Sugar Planters' Association Experiment Station, Hawaii Agricultural Experiment Station, U.S. National Museum, and Board of Agriculture and Forestry.

Collected on: *Cyathodes, Eragrostis variabilis*.

Balclutha beardsleyi, new species

In general appearance this species resembles *B. hospes*. However, it can be separated from the latter by its smaller size, the seventh sternite of the female, cylindrical proboscis, and the structure of the male genitalia.

Body length: ♂, 2.7–3.2 mm.; ♀, 2.8–3.3 mm.

Head and pronotum almost milky white; forewings nearly hyaline, in some specimens infuscate. In some specimens clypeus with brown grill and median line of crown and a spot on each side of median line on hind margin brown. Scutellum with two yellow spots on fore margin, one on each side of median line. In some specimens pronotum with brown markings.

Head width equal to or slightly greater than that of pronotum. Crown in dorsal aspect broadly rounded anteriorly, fore and hind margins parallel, the length along median line definitely less than half interocular distance. Ocellus less than its diameter from medial margin of eye. Clypellus with straight parallel or slightly concave lateral margins; width equal to or slightly greater than that of lorum. Proboscis cylindrical.

Pygofer of male with area caudad to row of bristles membranous, thus caudal margin appears irregular. Style shorter than connective; aedeagal base flattened; aedeagal shaft acuminate (fig. 11A). Seventh sternite of female with sharply pointed lobe on middle of posterior margin, not brown on disc (fig. 11B).

Holotype ♂ and allotype ♀: Honolulu, Oahu, Jan., 1955, at light, J. W. Beardsley. Both specimens deposited in the collection of the Hawaiian Sugar Planters' Association Experiment Station.

Paratypes 38 ♂♂, 70 ♀♀: OAHU.—1 ♂, Ewa Coral Plain, June, 1955, light trap, J. W. Beardsley; 15 ♂♂, 46 ♀♀, Honolulu, Jan., 1955, at light, J. W. Beardsley; 18 ♂♂, 12 ♀♀, Honolulu, Jan. 28, 1955, at light, J. W. Beardsley; 4 ♂♂, 10 ♀♀, Honolulu, Mar. 7, 1955, J. W. Beardsley; 1 ♀,

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FIG. 1. *Balclutha kilaueae* (Kirkaldy). A, male genitalia, lateral aspect; B, connective and left style, dorsal aspect.

FIG. 2. *Balclutha usitata*, n. sp. A, male genitalia, lateral aspect; B, connective and left style, dorsal aspect.

FIG. 3. *Balclutha plutonis* (Kirkaldy). Male genitalia, lateral aspect.

FIG. 4. *Balclutha grandis*, n. sp. A, male genitalia, lateral aspect; B, connective and left style, dorsal aspect.

FIG. 5. *Balclutha lobata*, n. sp. A, male genitalia, lateral aspect; B, connective and left style, dorsal aspect; C, posterior portion of seventh sternite of female, ventral aspect.

FIG. 6. *Balclutha hospes* (Kirkaldy). A, male genitalia, lateral aspect; B, posterior portion of seventh sternite of female, ventral aspect.

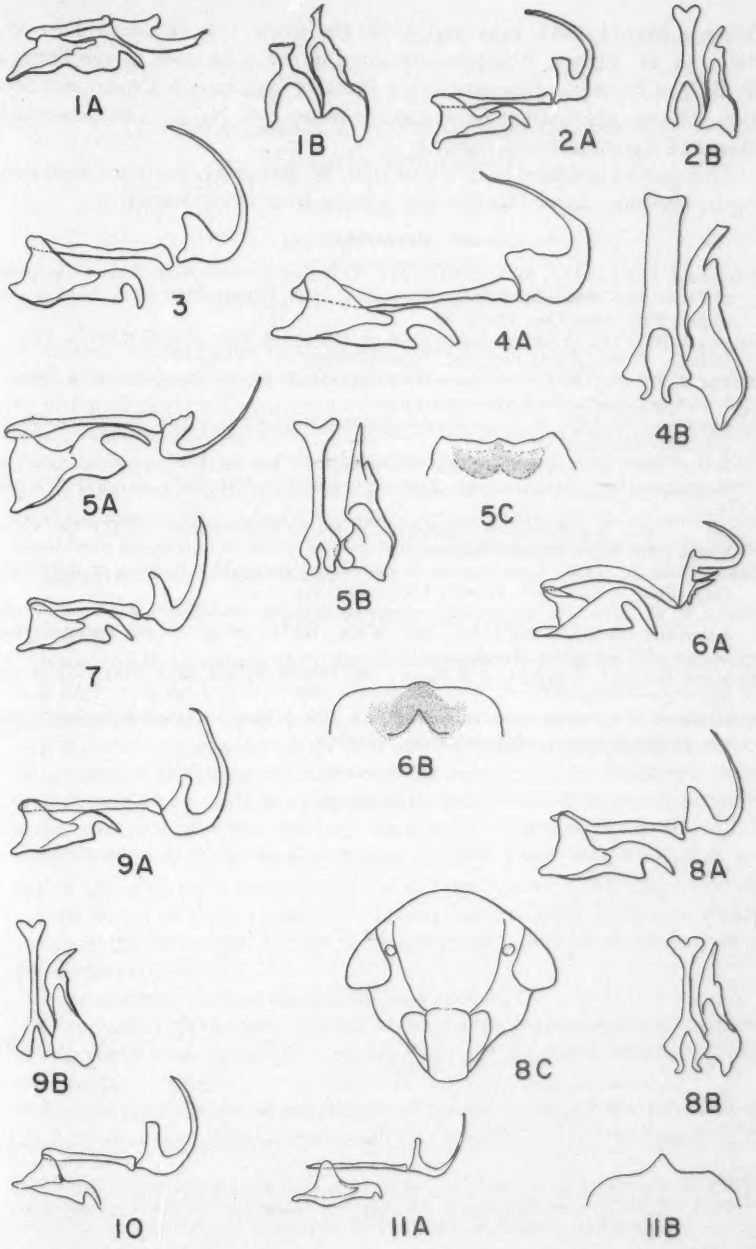
FIG. 7. *Balclutha volcanicola* (Kirkaldy). Male genitalia, lateral aspect.

FIG. 8. *Balclutha peregrina* (Kirkaldy). A, male genitalia, lateral aspect; B, connective and left style, dorsal aspect; C, head, frontal aspect.

FIG. 9. *Balclutha timberlakei* (Osborn). A, male genitalia, lateral aspect; B, connective and style, dorsal aspect.

FIG. 10. *Balclutha phoxocephala*, n. sp. Male genitalia, lateral aspect.

FIG. 11. *Balclutha beardsleyi*, n. sp. A, male genitalia, lateral aspect; B, posterior portion of seventh sternite of female, ventral aspect.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8C
8B
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11A
11B

Waipio, Mar. 2, 1955, light trap, J. W. Beardsley; 1 ♀, Waianae, Dec. 31, 1934, O. H. Swezey. Paratypes deposited in the collections of the Bernice P. Bishop Museum, Hawaiian Sugar Planters' Association Experiment Station, Hawaii Agricultural Experiment Station, U.S. National Museum and Board of Agriculture and Forestry.

This species is named in honor of John W. Beardsley, Assistant Entomologist, Hawaiian Sugar Planters' Association Experiment Station.

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The New Genus Tetracondyla in the Pacific (Acari: Oppiidae)

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(*Presented at the meeting of December 12, 1955*)

Among the Hawaiian Acari in the writer's collection is a rather unusual mite which does not seem to belong to any of the presently described genera of Oribatei. However, it appears to be congeneric with a number of species which various authors have described from widely scattered parts of the Pacific area under a variety of generic and subgeneric designations. A study of the Hawaiian species has made it possible to clarify the systematic position of these species and also the status of certain of the groups in which they have been arrayed. The latter points will be treated following the description of the genus and its type species.

Tetracondyla, new genus

Body and hysterosoma elongate, low-arched, hysterosoma of known species with at least some of the marginal setae projecting well beyond the posterior and lateral margins. Distinctive areae porosae absent. Propodosoma and hysterosoma separated from each other dorsally by an apparently flexible articulation characterized by four condyles (hence the generic name), ventral wall of podosoma with no corresponding articulation. Dorsum of propodosoma with lamellae but without translamella. Epimeral areas III and IV collectively with about 8 pairs of setae. Genital plates with four pairs, anal plates with two pairs of setae, at least in type species. Chelicerae of normal chelate form; palpi 4-segmented, tibia and tarsus fused. Tarsus of all legs monodactyle in known species. External sexual dimorphism absent except for smaller size of male.

Type species: *Tetracondyla pallida*, new species.

Distribution: Java, New Guinea, Hawaii, Juan Fernandez Islands. Species of this genus have not yet been reported from the Asiatic and South American mainlands.

The form of the dorsal solenidion of the tibiotarsus of the palp and the chaetotaxy of the genital and anal sclerites would place the new genus in the

[1] The drawings in this paper were prepared by Mari Riess of the University of California at Riverside. The scales provided are marked off in 10μ units. This study was supported jointly by the University of Hawaii and the University of California at Riverside.

family Oppiidae Grandjean. It resembles *Oppia* Koch, 1836, but differs most strikingly from that genus in the structure of the junction of the propodosoma and hysterosoma (*Oppia:* a narrow and continuous suture line without condyles), the presence of four pairs of setae on the genital plates (*Oppia:* five to six pairs in all species known to the writer), the partial fusion of tibia and tarsus I and II (*Oppia:* these segments freely articulating, tarsi with a very short peduncle), the large size of the genital acetabula (*Oppia:* these structures usually small and less conspicuous), and the partial separation of epimera III and IV by an apodeme extending about half-way across the width of the area (*Oppia:* epimeral areas III and IV usually broadly joined across the entire width).

Tetracondyla pallida, new species

Adult female: 536–558 μ long to tip of propodosoma, 221–270 μ wide at widest part of hysterosoma, length/width 2.06–2.22 (average of 5 females 542 μ long, 248 μ wide, length/width 2.14). Color pale straw-yellow, legs yellowish-brown. Dorsum of propodosoma (fig. 1) with lamellae well-developed, cusps and translamella absent. Distal end of sensilla (*ss*) fusiform, directed laterally; pseudostigmata opening anteriorly (fig. 12). Parasensillar (*pss*) seta anterolateral to base of sensillum, moderately long and slender; interlamellar setae (*ils*) thick, stiff, faintly pectinate. Lamellar (*ls*) and rostral setae (*rs*) long, simple to very faintly pectinate, curved. Lamellae nearly parallel throughout most of length, diverging sharply near posterior ends. Posterior margin of propodosoma with two condyles on either side of midline articulating with two opposing condyles on anterior margin of hysterosoma. Interval between propodosoma and hysterosoma evidently occupied by membranous cuticle on dorsal surface of body, but body as a whole not flexible at this point. Dorsum of hysterosoma (fig. 2) with ten pairs of long, heavy setae, smooth to faintly pectinate at high magnification. Areae porosae absent. Cuticle of entire dorsum faintly and uniformly punctate at high magnification; cuticle just lateral to lamellae of propodosoma minutely tuberculate.

All epimeral areas fairly well defined except for III and IV which coalesce medially; chaetotaxy as shown in figure 4. Tectopedia I and II well-developed; I with lateral surface somewhat paneled. Genital sclerites with four pairs of setae, the anterior two pairs nearest the medial margin, the posterior two pairs nearest the lateral margin. Two pairs of large block-like genital acetabula. Ventral plate with four pairs of setae. Anal plates considerably larger than genital plates, bearing two pairs of setae. Hysterosoma containing up to eight eggs.

Palpi (figs. 3, 5) four-segmented. Trochanter very small, appearing incomplete dorsally. Femur with one dorsal and two ventral setae; patella also with three setae. Tibia and tarsus completely fused. A prominent pit-like

depression dorsally at base of tibiotarsus. A dorsal and a ventral eupathid (*e*) at about 0.72 and either one or two eupathids terminally (extremely difficult to resolve). The solenidion (*s*) is recumbent along the dorsal surface of the tibiotarsus; otherwise with four normal setae. Chelicerae (fig. 17) of normal chelate form. Chaetotaxy of legs (s = solenidia, e = eupathidia, f = famulus, n = normal setae, c = companion seta):

	TR	FE	PA		TI		TA				
	n	n	s	n	s	n	s	e	f	n	c
I	1	4	1	3	2	4	2	3	1	12	0
II	1	4	1	3	1	3	2	0	0	15	0
III	2	3	0	2	0	3	0	0	0	14	0
IV	1	2	0	2	0	3	0	0	0	12	0

Patella I and II with a dorsal solenidion each; tibia I with two solenidia, II with one. Tarsus I with two solenidia, three eupathids, and a terminally swollen famulus (*f*, figs. 14, 15). The unpaired eupathid is located distiventrally. No companion setae could be found. Tarsus II lacking eupathidia, but with two dorsal solenidia (fig. 16). Tarsi I and II appear to be inflexibly joined to their respective tibiae, but III and IV are normally joined. The basiventral seta of tarsus IV is greatly expanded distally, flat, and peripherally pectinate (fig. 18). All tarsi with a single heavy claw.

Male: Resembling female in all essential respects except for smaller size and the structure of the internal genitalia. Body length 445 to 450 μ, width 198 to 207 μ, length/width 2.19 to 2.22 (two specimens). Of the nine specimens of this species in the writer's collection, six are females and three are males.

Type locality: Nuuanu water reserve, Nuuanu Valley, Oahu, Hawaii, November, 1952, I. M. Newell. Types in author's collection.

This mite was found in a sample of leaf litter from a tropical rain forest at an elevation of about 1,000 feet. It has not been found in collections from other parts of Oahu, or from other islands.

In general this species and others of the genus appear to be more primitive in structure than members of the genus *Oppia*. *T. pallida* cannot be differentiated from *T. damoeoides* (Berlese, 1913) on the basis of any characters mentioned in the original description of the latter species, but considering the wide geographical separation of the two forms, it is unlikely that they are identical unless by direct introduction from one region to the other. Berlese described the Java species as dark brown, while the Hawaiian form is very pale. This of course is only indicative of a probable difference between the two, but it is likely that other differences would be found upon direct comparison. *T. pallida* can be separated readily from the other species of the genus on the basis of the characters given in the formula key below.

Summary of Other Species in the Genus Tetracondyla

Tetracondyla crinita (Berlese, 1905), **new combination**

Carabodes (*Otocepheus*) *crinitus* Berlese, 1905, Redia 2:172.

This species was described from material collected at Buitenzorg, Java. A study of the original description reads essentially as follows (author's translation): Body hard, dark, 1,100 μ long. Cuticle of hysterosoma marked with elegant punctate areolae. Margin of hysterosoma with seven elongate setae on each side, of which the anterior three are somewhat anterodorsal. Pseudostigmatic organ long, clavate, bent forward at first, then backward. Anteromedian portion (of propodosoma) moderately elevated. Differs sharply from *Carabodes cristatus* Canestrini (New Guinea) in the longer body setae, but not in the structure of the pseudostigmatic setae (end of translation).

Berlese placed this species in his new subgenus *Otocepheus*, the type species of which was *Otocepheus longior* (Berlese, 1905). However, a study of Berlese's figures of the two forms shows that they are considerably different and almost certainly not congeneric. At the same time *Carabodes* (*Otocepheus*) *crinitus* Berlese, 1905, is certainly congeneric with *Tetracondyla pallida*, and is therefore removed to the genus *Tetracondyla*.

Tetracondyla damoeoides (Berlese, 1913), **new combination**

Otocepheus damoeoides Berlese, 1913, Redia 9:93.

As indicated above, the original description of this species, based on material collected in Samarang, Java, contained no information which would enable us to separate it from *Tetracondyla pallida*, new species. The interlamellar setae in *T. damoeoides* appear to be somewhat longer and more tapering than in the type species, but this is not certain. The Java species is dark brown, while the Hawaiian form is pale, but this is only indicative of a probable difference between the two.

Tetracondyla longipila (Trägårdh, 1931), **new combination**

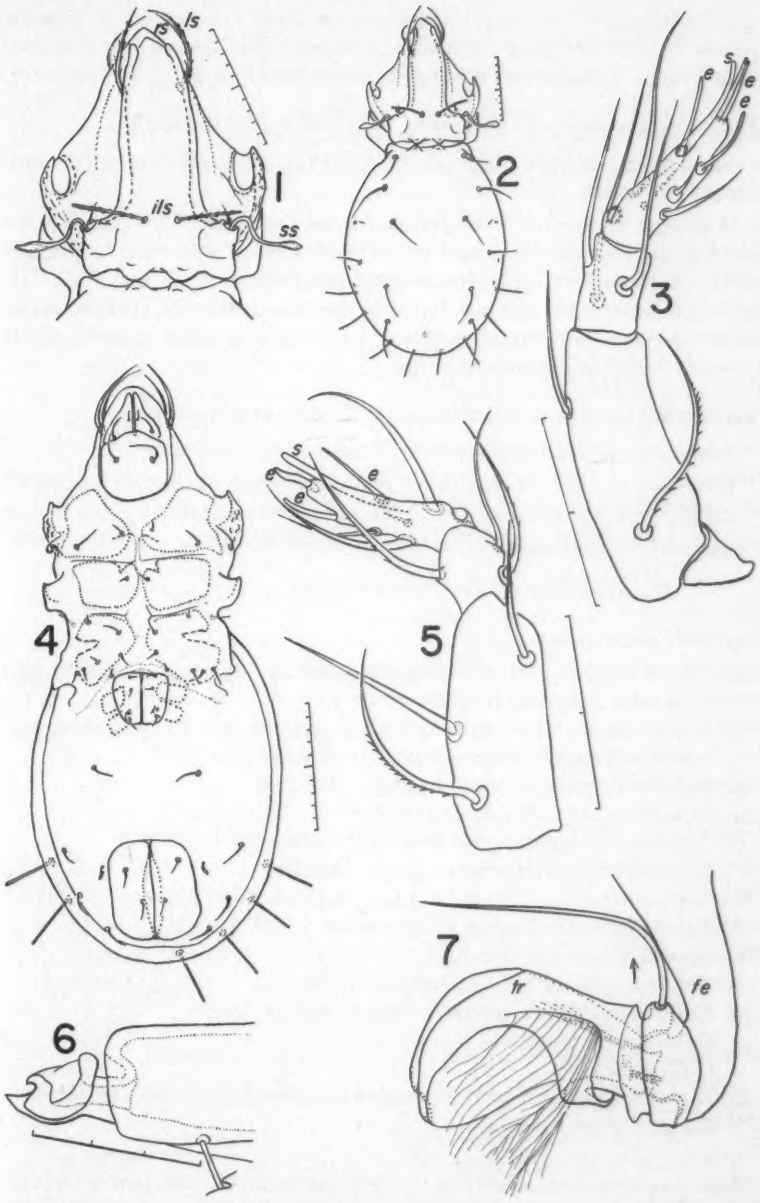
Otocepheus longipilus Trägårdh, 1931, Nat. Hist. Juan Fernandez and Easter Is. 3:584.

This species can be distinguished from all others presently described on the basis of the very long setae of the hysterosoma, all of which extend beyond the margin. The type material was collected in the Juan Fernandez Islands, about 400 miles west of the coast of Chile.

Tetracondyla sexdentata (Trägårdh, 1931), **new combination**

Odontocepheus sexdentatus Trägårdh, 1931, Nat. Hist. Juan Fernandez and Easter Is. 3:587.

Figs. 1–7. *Tetracondyla pallida*, n. sp. 1. Propodosoma, female. 2. Dorsum, female. 3. Palp, posterior aspect, female. 4. Venter, male. 5. Palp, posterodorsal aspect, male. 6. Base of femur. 7. Trochanter and femur II, left side, ventral view, showing insertion.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It is difficult to see why Trägårdh placed these two species in separate genera for they are quite certainly congeneric. This species was described from a single damaged individual collected at Puerto Ingles, Juan Fernandez.

Tetracondyla curtipila (Trägårdh, 1931), **new combination**

Odontocepheus curtipilus Trägårdh, 1931, NAT. HIST. JUAN FERNANDEZ AND EASTER IS. 3:588.

In general appearance this species is quite similar to *T. pallida*, but the lamellae are much shorter than in the type species, and other differences would probably be found upon a direct comparison of the two. Like Trägårdh's other species, this was found in the Juan Fernandez Islands (Masatierra) and was quite common, being found in 8 separate samples of dry leaves collected in different localities.

Tetracondyla cristata (Canestrini, 1897), **new combination**

Eremaeus cristatus Canestrini, 1897, TERMES. FUZ. 20:466.

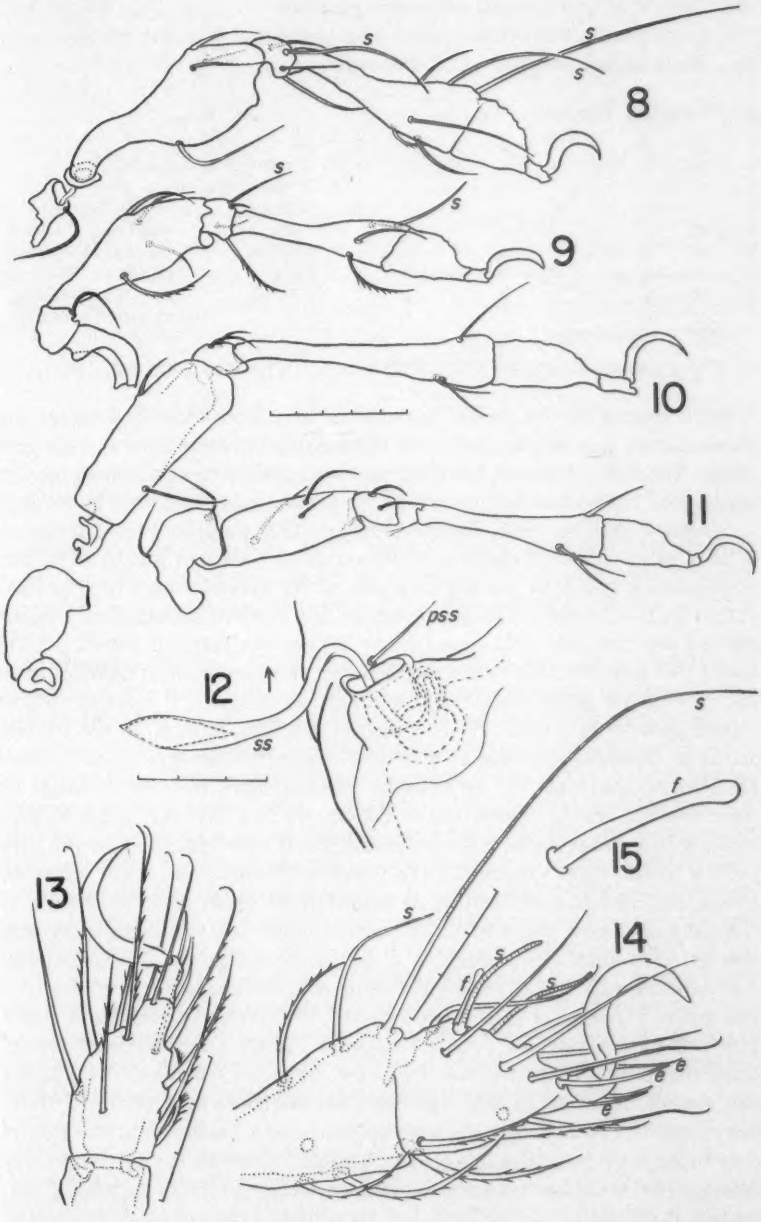
The writer has not yet seen the original description of the species, and its placement here is provisional, based upon Berlese's comparison of the species with *T. crinita* (Berlese, 1905). It was described from New Guinea material.

FORMULA KEY TO DESCRIBED SPECIES OF TETRACONDYLA

Characters and Variants

1a. Dorsal and marginal setae of hysterosoma all very long, projecting well beyond margin of hysterosoma.
b. Dorsal setae of hysterosoma shorter, at least two pairs of these not reaching to the margin of the hysterosoma (fig. 2).
2. Number of pairs of dorsal hysterosomal setae.
3a. Lamellae short, not reaching to level of lamellar setae.
b. Lamellae reaching beyond level of lamellar setae (fig. 1).
4. Number of pairs of setae on genital sclerites.
5a. Basiventral seta of tarsus IV greatly expanded and flattened distally.
b. Basiventral seta of tarsus IV otherwise.
6a. Sensillum fusiform distally.
b. Sensillum clavate or pyriform distally.
7a. Color yellowish, or yellowish with brown patches.
b. Color light brown.
c. Color dark brown.
8a. A median elongate, oval depression between the interlamellar setae.
b. No such depression here.

FIGS. 8–15. *Tetracondyla pallida*, n. sp. 8. Leg I, male. 9. Leg II, male. 10. Leg IV, male 11. Leg III, male. 12. Left sensillum, female, dorsal view. 13. Tarsus III, female. 14. Tarsus and tibia I, female. 15. Famulus of tarsus I.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9a. Cuticle of hysterosoma uniformly punctate.
b. Cuticle of hysterosoma marked with polygonal punctate panels.
10. Body length (by sex, where known.)

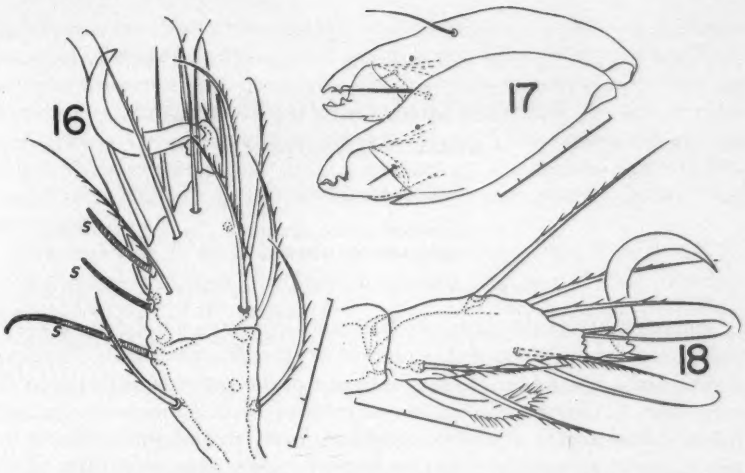
Distribution of Variants

1	2	3	4	5	6	7	8	9	10	
b	10	b	4	a	a	ab	b	a	♀ 536–558 μ ♂ 445–450 μ	*pallida*, n. sp.
b	?	a	?	?	a	c?	?	b	1100 μ	*crinita* (Berlese)
b	10	b	?	?	a?	c	b?	?	560 μ	*damoeoides* (Berlese)
b	10	a	?	?	a	b	b	?	880–900 μ	*curtipila* (Trägårdh)
b?	10	a	?	?	b	b	b	?	890 μ	*sexdentata* (Trägårdh)
a	12	a	3?	?	a	a	a	?	1100 μ	*longipila* (Trägårdh)
?	?	?	?	?	?	?	?	?	?	*cristata* (Canestrini)

Otocepheus Berlese, 1905, and Odontocepheus Berlese, 1913

Since species of the genus *Tetracondyla* have been described under the above names, it is well to clarify the relationship between these and the new genus. Trägårdh (1931, pp. 580–581) reviewed the history of these two genera established by Berlese, but certain of his conclusions must now be revised.

Otocepheus Berlese, 1905. Berlese (1905, p. 172) published no description of this group; he regarded it as a subgenus of *Carabodes* Koch, 1836, but established it solely by placing in it two of the species which he described at that time—*Carabodes* (*Otocepheus*) *longior*, and *Carabodes* (*Otocepheus*) *crinitus*. Neither was designated the genotype by Berlese but Trägårdh (1931, p. 581) stated: "*O. longior* having been described first, this species must be considered the type of the genus *Otocepheus*, the diagnosis of which I propose to formulate as follows:" (etc.). Thus Trägårdh not only recognized the generic status of *Otocepheus* but also at that time designated the type of the genus. He also pointed out: "If we examine the diagnoses and the drawings of these two species, *O. crinitus* and *O. longior*, we find that they differ so profoundly in some essential respects, that it seems very doubtful whether they belong to the same subgenus." He stated somewhat later: "This leaves *O. crinitus* out, and as it can neither be placed in *Carabodes* sensu stricto nor in *Odontocepheus* a new genus must be created, which will also include the new species from Juan Fernandez. As a further investigation of the tropical acarina-fauna will undoubtedly yield many new forms more or less related to this genus, I think it is most appropriate to defer the establishment of a new genus till more forms have been investigated." While Trägårdh clearly recognized that a new genus was involved here, he did not name it. Two of his new species, *Otocepheus pacificus*, and *Otocepheus longipilus*, were described under this name. The first of these does not appear to be a *Tetracondyla*, and for the time being must be left in the genus *Otocepheus*, to which it may or may not belong. The writer has removed the second species to the new genus *Tetracondyla*. It should be pointed out that the tibia and the tarsus of the palp of



FIGS. 16–18. *Tetracondyla pallida*, n. sp. 16. Tarsus II, female. 17. Chelicerae, female. 18. Tarsus IV, female.

Otocepheus pacificus Trägårdh, 1931, are not fused, and moreover tarsus I appears to be flexibly articulated to tibia I. In both of these important characteristics the species differs from *T. pallida*, assuming Trägårdh's figures to be correct.

Odontocepheus Berlese, 1913. This was also established as a subgenus of *Carabodes* Koch, and Berlese designated *Tegeocranus elongatus* Michael as type. Berlese described *Odontocepheus* as follows: Hysterosoma with anterior margin bidentate; posterior margin of propodosoma also bidentate, the teeth of the propodosoma and the hysterosoma contiguous. Otherwise as in the subgenus *Carabodes* (author's translation). Trägårdh (1931, p. 581) pointed out that Michael did not mention or delineate any teeth on the propodosoma or hysterosoma of *Tegeocranus elongatus*, and queried why Berlese designated this as the type species of his *Odontocepheus*. It should be pointed out, however, that other European workers have subsequently published figures of *Odontocepheus elongatus* (Michael) which clearly show four opposing teeth on the propodosoma and hysterosoma. Therefore *Odontocepheus* was appropriately described, and the type species was properly designated. We can conclude then that despite the vagaries referred to by Trägårdh the type species of *Otocepheus* and *Odontocepheus* are well established and generically distinct. Moreover neither of these is congeneric with *Tetracondyla pallida*.

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TRÄGÅRDH, IVAR. 1931. Acarina from the Juan Fernandez Islands. NAT. HIST. JUAN FERNANDEZ AND EASTER ISLAND, ZOOL. 3(4):553–628.

A Parasitic Species of Copidognathus (Acari: Halacaridae)

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(*Presented at the meeting of December 12, 1955*)

Most members of the subfamily Halacarinae are known to be or considered predacious, feeding upon small Crustacea or other minute animals. The genus *Copidognathus* Trouessart, 1888, the largest of the entire family Halacaridae with nearly 125 known species, has no members with demonstrated parasitic habits. Consequently, it is of considerable interest to find one species of this genus in Hawaii which is definitely parasitic on a marine crustacean.

The species was found by Dr. Donald C. Matthews of the Department of Zoology and Entomology of the University of Hawaii during the course of investigations on *Parribacus antarcticus* (Lund) (Decapoda, Scyllaridae). The species apparently lives as a parasite on the gills of this crustacean, for it has been found there in all stages, including eggs, and in great numbers. The filaments of gills infested by this mite sometimes show necrotic spots apparently due to the feeding activities of the mite.

It might be supposed that this species would differ noticeably from others of the genus with more normal habits, but this does not seem to be the case. In virtually all respects it is a perfectly typical *Copidognathus*. The species is named for Dr. Matthews who discovered it and made the observations upon its parasitic habits.

Copidognathus matthewsi, new species

Male. Body 447 to 486 μ long, 272 to 318 μ wide, length/width = 1.47–1.67; average 460 by 305 μ, length/width = 1.59 (five specimens). Anterior dorsal plate uniformly covered with porose panels, elevated areas totally lacking; setae well anterior to middle of plate (fig. 2). Second pair of dorsal setae in very margin of ocular plate or just outside and contiguous with it; not lying free in membranous area (fig. 1). Ocular plate with two corneae, porose panels as on anterior dorsal plate. Third pair of dorsal setae in posterior dorsal plate, costae totally absent; porose panels as on anterior dorsal plate, uniformly distributed. Anterior epimeral, posterior epimeral, and genitoanal plates uniformly marked with porose panels like those on anterior

[1] The drawings for this paper were prepared by Mari Riess of the University of California at Riverside. The scales provided are marked off in 10 μ units. This study was supported jointly by the University of Hawaii and the University of California at Riverside.

dorsal plate, but these are somewhat more densely packed (fig. 14). Epimeral processes of coxae I and II absent. Third pair of setae widely removed from posterior margin of anterior epimeral plate. Posterior epimeral plate with the usual three pairs of ventral setae (third pair duplicated on right side of specimen drawn). Genitoanal plate with 13 to 17 (av. 15.6) perigenital setae on each side (seven specimens). Genital sclerites not pronounced (fig. 4); subgenital setae slender, smooth, third pair shorter than others (fig. 4). Anal papilla prominent.

Chelicerae (fig. 3) small, but normal for genus; palpi also typical (fig. 7). Rostral sulcus 0.70 to 0.74 as long as rostrum, first pair of long maxillary setae 0.18 to 0.27 of the length of the sulcus from the posterior end of the sulcus. Chaetotaxy of legs (except for parambulacral setae and bacillum) as follows:

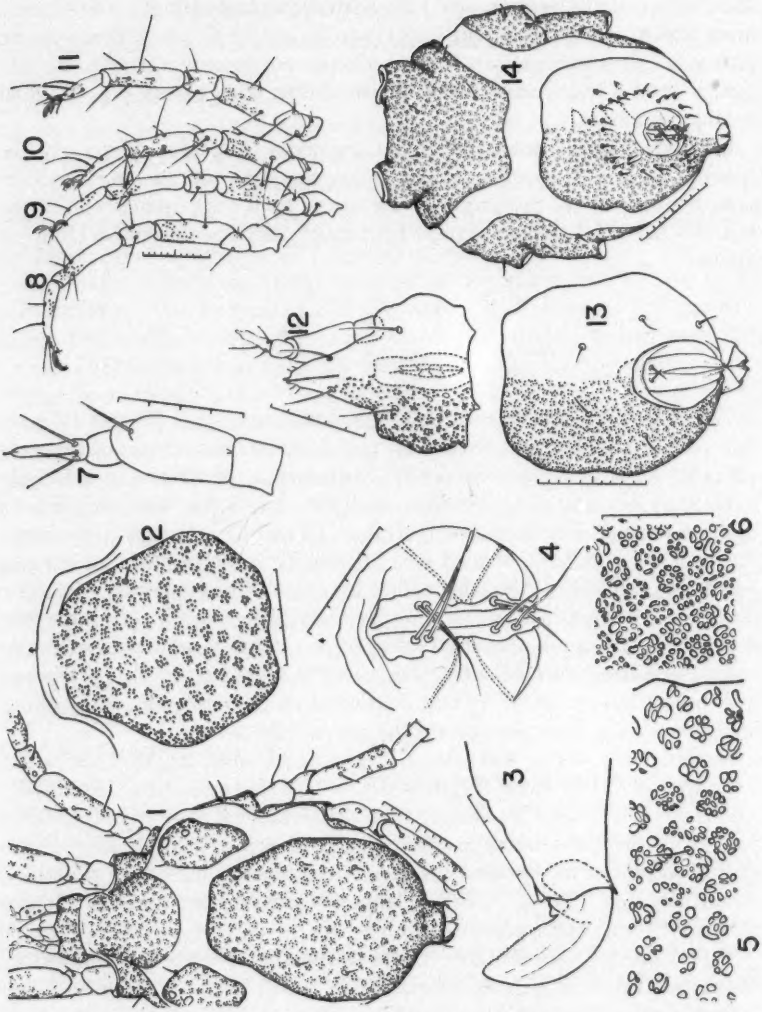
	tr	bf	tf	pa	ti	ta
I	1	2	5	4	7	6
II	1	2	5,4	4	7,6	3
III	1	2	2	3	5	4
IV	0	2	2	3	5	4

Telofemora III and IV with only two setae each; tarsi III and IV with four setae each. Bacillum present on tarsi I and II; parambulacral setae divaricate on tarsus I, *but single on II*. Medial setae of tibiae I and II only moderately heavier than other setae, and with only a few faint pectinations in distal portion. Distimedial seta of tibiae III and IV delicately bipectinate. Posterior parambulacral seta of tarsi III and IV long, bacilliform, anterior one short, spiniform. All claws with a long, well-formed pecten extending down axial margin of claw, around the outer aspect and a very short way down the outer margin, forming a J-shaped pecten and an apparent "accessory tooth." Median claw distinctly bidentate. All segments of all legs marked with porose panels which are best developed on the telofemur, diminishing in regularity and pore size toward the tarsus (figs. 8–11).

Female. Body 421 to 480 μ long, 259 to 311 μ wide, length/width 1.50–1.62; average 454 by 285 μ, length/width = 1.58 (five specimens). Essentially similar to male, except for characters of the genitoanal plate (fig. 13). Three pairs of perigenital setae as in other species of genus; a single pair of subgenital setae. Genital opening displaced from anterior margin of plate by a distance of 1.51–1.80 (av. 1.65) of length of genital opening from anterior margin of plate (five specimens).

Type locality: Kaneohe Bay, Oahu, Hawaii, May 29, 1952, Donald C. Matthews. Types in author's collection.

Parasitism is not common in the Halacaridae, there being only three genera in which parasitic species are known and for each of them a separate subfamily has been established by Viets. At least two of these are monotypic genera. *Halixodes chitonis* (Brucker, 1897) (subfamily Halixodinae Viets, 1927) is known only from the deutonymph found attached to the gills of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Acanthochiton porosus (Burron) (Mollusca, Amphineura) in New Zealand, while *Halixodes truncipes* (Chilton, 1883) is known only in the free living adult stage, and also from New Zealand. It is not impossible that these are the same species. *Enterohalacarus minutipalpus* Viets, 1938, (subfamily Enterohalacarinae Viets, 1938) is parasitic in the gut of sea urchins (*Plesiodiadema indicum* (Doderlein)) taken at depths of 430 meters in the Sulu Sea. Both females and nymphs were found in the gut. *Astacopsiphagus parasiticus* Viets, 1931, (subfamily Astacopsiphaginae Viets, 1931) has been found on a fresh water decapod, *Astacopsis serratus*, in Australia. Only nymphs have been found, attached to the gills by their chelicerae; the other stages are not yet known. All three genera in which parasitic species of Halacaridae have been described are quite unrelated, indicating that parasitism has shown up in at least three different parts of the family. The species described above provides no exception to this, but it is evidently a form in which the parasitic habit has arisen relatively recently, for with the exception of its habits, *Copidognathus matthewsi* is in all respects a typical *Copidognathus*. It would be interesting to see if the same species of mite were found in all parts of the range of this particular decapod. This would shed further light on just how recently the parasite has evolved.

This species keys out to *Copidognathus reticulatus* (Trouessart, 1894), and *C. latus* Viets, 1927, in Viets' key (1940), but differs from both in many respects. Of all the species described by the writer it resembles *Copidognathus acutus* Newell, 1947, most closely, but the differences are too many to justify a detailed comparison. Using the formula key to species of *Copidognathus* prepared by the writer (1951, pp. 3–4), *C. matthewsi* has the following diagnostic formula: 1a, 2a, 3b*a*, 4a, 5b, 6ab, 7ab, 8a*b*, 9a, 10b, 11a, 12a. The complete absence of costae and rosette pores, as well as its habitat, distinguish this species from all others which it otherwise superficially resembles.

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Figs. 1–14. *Copidognathus matthewsi*, n. sp. 1. Dorsum, male. 2. Anterior dorsal plate, male. 3. Terminal portion of chelicera. 4. Genital opening, male. 5. Cuticular detail in posterior dorsal plate at level of 4th dorsal seta. 6. Cuticular detail in genitoanal plate, female. 7. Palp, male. 8. Leg IV, male. 9. Leg III, male. 10. Leg II, male. 11. Leg I, male. 12. Gnathosoma, male. 13. Genitoanal plate, female. 14. Venter, male.

An Experimental Study of the Ovipositional Behavior of Opius fletcheri Silvestri (Hymenoptera: Braconidae), a Parasite of the Melon Fly[1]

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(*Presented at the meeting of December 12, 1955*)

Among the parasites of the melon fly, *Dacus cucurbitae* Coquillett, established in Hawaii is *Opius fletcheri* Silvestri, a braconid parasite introduced by D. T. Fullaway from India in 1916. It oviposits in the second and third instar larvae of the melon fly present in the tissues of its host plants. Development takes place within the host larva and, when fully grown, the adult parasite emerges from the puparium of the melon fly (Willard, 1920).

The melon fly has a wide host range and the extent of parasitization of the larvae by *O. fletcheri* has been observed to vary with the kind of plant in which the host larvae are present. Field data of Willard (1920) show that the percentage of parasitization was lower among larvae infesting cucumber fruits than those infesting the wild balsam apple, *Momordica balsamina* L. Recent field observations made on a wide variety of host plants also showed that the parasitization of larvae infesting cultivated plants was consistently lower than those infesting the wild balsam apple (Nishida, 1955). These observations also showed that, although the incidence of parasitization was generally low, there was a definite indication that the larvae in the vines of certain plants, such as pumpkin and watermelon, were parasitized to a greater extent than those in the fruit.

In view of these observations, investigations were made to determine some of the underlying causes of the variation in parasitization of melon fly larvae infesting various plants by *O. fletcheri*. The present paper is concerned primarily with the oviposition behavior of *O. fletcheri* as influenced by the kind of medium in which its host larvae are present.

METHOD

The oviposition behavior of *O. fletcheri* was observed in cages made of a gallon size glass jar with a screw cap cover (fig. 1A). This type of cage, which

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is similar to those used by other investigators, is constructed by cutting off the bottom of the jar and covering the opening thus formed with thin organdie, of approximately 50 meshes per linear inch (fig. 1E). A circular opening was cut out in the screw cap cover, and the opening thus formed was covered with a 32 mesh per linear inch plastic screen (fig. 1D). Five females were kept in each cage. They were fed on honey by smearing small quantities of honey on a strip of celluloid. A vial containing absorbent cotton saturated with water was also placed in each cage (fig. 1C, 1G).

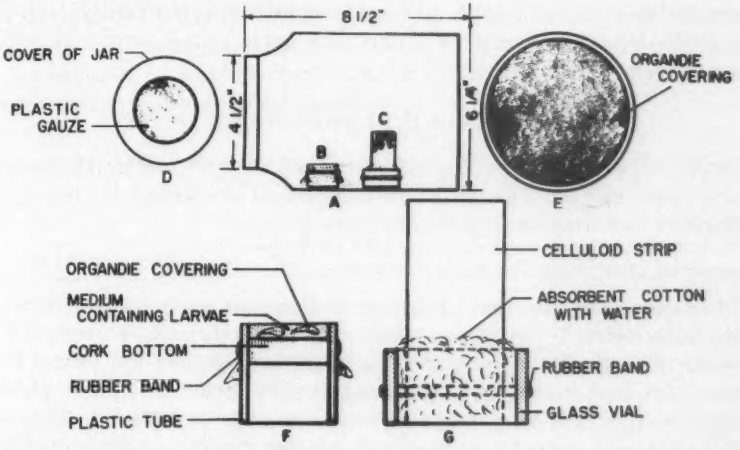

FIG. 1. Showing parasite cage and larval container used in this study. A. Glass jar with vial B containing melon fly larvae and vial C containing absorbent cotton saturated with water and a strip of celluloid on which honey is placed. D. End view of the cage showing plastic gauze in place. E. End view of cage showing the organdie covering. F. Detail sectional view of vial B. G. Detail sectional view of vial C.

The type of container used in confining melon fly larvae when exposing them to the parasites was a vial with a movable bottom which permitted the adjustment of the depth of the vial (fig. 1B, 1F). This vial, which restricted the movement of the larvae to a prescribed depth, was constructed from a plastic tubing with an internal diameter of one inch. The tubing was first cut into one inch segments and a tight-fitting cork approximately ¼ inch in thickness was inserted into each segment. This cork, which formed the bottom of the vial, was movable and, hence, the depth of the vial could be adjusted to any desired depth. In these studies the depth was adjusted to 3 mm.

The plant tissues used as media for exposing melon fly larvae to *O. fletcheri* were first chopped with a knife into small pieces. The pieces were then chopped fine by means of a Waring blendor with sufficient water added to

facilitate the action of the blendor. After about 30 seconds of grinding, the finely chopped plant tissue was emptied on a sheet of muslin and excess water squeezed out.

In exposing melon fly larvae to parasitization, a small amount of the finely ground plant tissue was first placed in the plastic vial and 15 to 25 fully grown larvae were placed in each vial. The top of the vial was then covered with a sheet of thin organdie which was held tightly stretched by means of a rubber band (fig. 1F). To determine the per cent parasitization one vial was placed in each cage containing five females. After one hour the larvae were removed from the vial and placed on sand in rearing jars described by Newell *et al* (1951). Upon emergence counts were made of the number of adult parasites and flies.

The Influence of Host Media on Attraction

Before egg deposition within the host larvae can occur, the female parasite must locate its host. The role of the larval media in enabling the female to locate its host was investigated.

Attraction of O. fletcheri to media

Experimental studies were carried out to determine whether the medium in which the melon fly larvae are present or the larvae themselves attracted the female of *O. fletcheri* to its host larvae. Vials with ground leaf tissues and those with stem tissues each containing 25 fully grown larvae were placed singly in cages each containing five gravid females of *O. fletcheri*. In addition vials containing ground leaf tissues and also stem tissues without larvae were placed in separate cages. Vials which contained 25 larvae without any medium were also placed in similar cages. The attraction of the respective vials to the females was then determined by counting the number of female parasites on the vials at 5, 10, 15, 20, 25, 30, 40, and 60 minutes after placing the vials in the respective cages. The counts which represent a mean of five replicates are shown in table 1.

The results show that (1) the female parasites were attracted to the vials containing the media regardless of whether or not the host larvae were present and (2) the female parasites were not attracted to vials which contained only larvae. The number of females observed on vials with media and larvae, and those with media alone was approximately the same soon after the vials were placed in the cages; however, subsequently there was a general decrease with time. This decrease occurred because when host larvae were present the females remained on the vials for long periods walking over the vials, stopping periodically to oviposit. However, in the absence of larvae the females walked over the vials for a short time making no attempts to oviposit. These observations show that the gravid females are attracted not to the host larvae, but to the media in which the host larvae are present.

A similar experiment was performed in order to determine whether females of all ages behaved in the same manner as the gravid individuals. Three newly emerged males and five newly emerged females were placed in a series of cages. From the day of emergence up to the time the parasites were 22 days old, separate vials containing watermelon and pumpkin vine media, each with 15 larvae, were placed in the respective cages. The number of females on the respective vials was counted as in the previous experiment.

The results of this study show that females younger than three days were not attracted to the media. Females began to be attracted to the media when 4 to 5 days old, and thereafter the number of parasites counted in the respective vials remained nearly constant for 22 days. Because the preoviposition period of *O. fletcheri* is about 3 days it appears that egg development and attraction to media are closely associated.

TABLE 1. The attraction of gravid *O. fletcheri* to vials containing medium alone, medium and host larvae, and host larvae alone.

TIME AFTER PLACING VIALS IN CAGES (minutes)	MEAN NUMBER OF PARASITES OBSERVED ON VIALS CONTAINING				
	Pumpkin leaf		Pumpkin stem		Larvae alone
	With larvae	Without larvae	With larvae	Without larvae	
5	3.0	3.8	2.8	2.2	0
10	4.2	2.8	3.2	1.8	0
15	3.8	2.2	3.4	1.2	0
20	3.0	1.8	1.6	1.0	0
25	3.6	1.8	1.8	0.6	0
40	3.0	1.0	1.4	0.4	0
50	2.8	1.2	0.8	0.4	0
60	1.6	1.0	1.4	0.4	0

Similar experiments were also carried out to determine whether the males behaved in the same manner as the females. There was no evidence that the males were attracted to the media.

Variation in attractiveness of different media

The relative attractiveness of various media to gravid females was determined by placing a known number of females in cages and placing vials containing various media with melon fly larvae in the cages. Five gravid parasites per cage and 25 larvae per vial containing different media were used. At 5, 10, 15, 20, 30, 40, and 60 minutes after placing the vials in the cages, counts were made of the number of individuals present on the respective vials. The total number of females observed per vial is referred to as the index of attraction. The mean indices obtained from five observations are summarized in fig. 2.

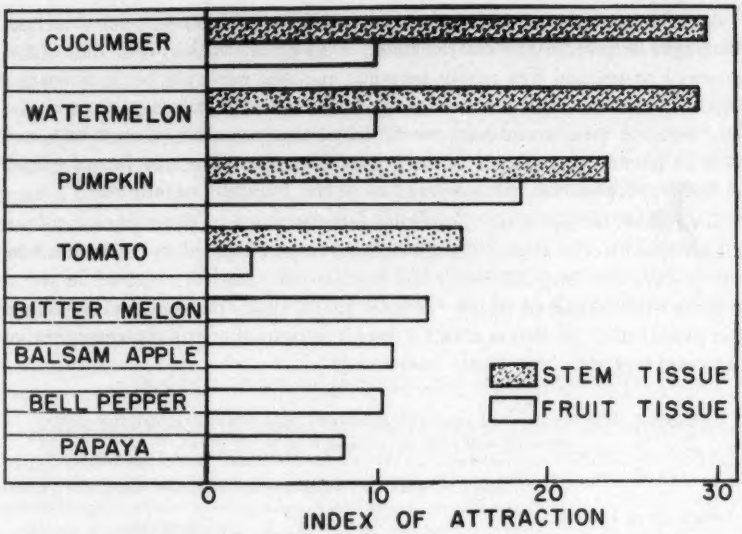

FIG. 2. Variation in the index of attraction of various plants as well as that of fruit and stem tissues. The plants listed are cucumber, *Cucumis sativus;* watermelon, *Citrullus vulgaris;* pumpkin, *Cucurbita pepo;* tomato, *Lycopersicon esculentum;* bitter melon, *Momordica charantia;* balsam apple, *Momordica balsamina;* bell pepper, *Capsicum frutescens* var. *grossum*; and papaya, *Carica papaya.*

The result shows that there is a considerable variation in the index of attraction of different media. Of particular interest is the greater attractiveness of the stem over fruit tissues of the plant. The greater attractiveness of stem over fruit tissue is evident even in the case of the tomato plant, the stem of which is not attacked by the melon fly. Among fruit tissues, the medium consisting of ground tomato fruit was the least attractive.

THE INFLUENCE OF HOST MEDIA ON OVIPOSITION

Stimulus to oviposition

When a female of *O. fletcheri* comes in contact with a suitable medium, she walks over the surface, stopping periodically, apparently in search of the host larvae. When she comes to a spot where there is a larva in the medium, she raises the abdomen and inserts the ovipositor through the medium and into the body of the larva. In vials containing a suitable medium but without larvae, the parasite made no attempt to insert the ovipositor into the medium. Oviposition, therefore, appears to be stimulated not by the medium, but by the host larva.

An experiment was carried out to determine whether larvae of other Diptera would stimulate oviposition when present in a suitable medium. The larvae of the melon fly, *Dacus cucurbitae* Coquillet; oriental fruit fly, *D. dorsalis* Hendel; housefly, *Musca domestica* L.; and scavenger fly, *Atherigona excisa* (Thomson), were placed in separate vials containing various media. Vials containing these various larvae were then placed individually in cages each containing five gravid females of *O. fletcheri*. In addition, vials containing larvae without medium were placed in similar cages. Observations were made on oviposition for one hour and each larva was dissected to determine whether or not oviposition had taken place.

This experiment showed that gravid females were attracted to all of the vials containing media, regardless of the species of larva present in the medium. However, the act of oviposition was observed only among females present on vials containing the larvae of the melon fly, oriental fruit fly, and the housefly. The parasites made no attempt to oviposit in the larvae of the scavenger fly which, incidentally, is considerably smaller than those of the other species. Dissection of the larvae showed that actual egg deposition occurred only in the larvae of the melon and the oriental fruit flies (table 2). This experiment also showed that *O. fletcheri* is not attracted to vials without any medium and, hence, there was no egg deposition in larvae in such vials.

TABLE 2. Egg deposition by *Opius fletcheri* in the larvae of four species of flies when placed in media attractive to the parasite. Egg deposition was determined by dissection.

SPECIES OF LARVAE EXPOSED	NUMBER OF REPLICATES	TOTAL NO. OF LARVAE	PER CENT PARASITIZED IN THE INDICATED MEDIA			
			Pumpkin vine	Watermelon vine	Cucumber vine	Without medium
Melon fly (*Dacus cucurbitae*)	3	30	76.0	60.0	83.3	0
Oriental fruit fly (*Dacus dorsalis*)...	3	30	90.0	53.3	83.3	0
Scavenger fly (*Atherigona excisa*)	3	30	0	0	0	0
Housefly (*Musca domestica*).	3	30	0	0	0	0

Furthermore, these observations show that the medium does not stimulate the act of oviposition. Oviposition appears to be stimulated by the larvae within the host medium. These observations also indicate that the larvae of certain species stimulate oviposition while others do not. Lathrop and Newton (1933) reported that the stimulus to oviposition of *Opius melleus* Gahan, a parasite of the blueberry maggot, is the vibration produced by the movements of the host larvae within the plant tissue. They induced the act of oviposition of *O. melleus* by making simulated larval movements under the skin of the blueberry by means of a needle or a pair of forceps. If such

vibrations stimulate oviposition, then there must be differences in the characteristics of vibrations produced between larvae of species that do stimulate oviposition and those that do not.

The data obtained in the present study also indicate that, although the larvae of the housefly are capable of stimulating the act of oviposition, egg deposition does not take place, possibly because of certain unfavorable characteristics of the integument.

Relationship between the index of attraction and parasitization

A scatter diagram depicting the relationship between the index of attraction of various media and per cent parasitized larvae in the respective media is shown in fig. 3. With the exception of the tomato fruit medium, which had a low index of attraction and a corresponding low parasitization, all media prepared from fruit tissues were attractive enough to result in parasitization to an extent of 40 to 76 per cent under the conditions of the experiment. Media prepared from stem tissues were highly attractive; however, the percentage parasitization did not increase proportionately. Because of this deceleration the relationship between the index of attraction and parasitization

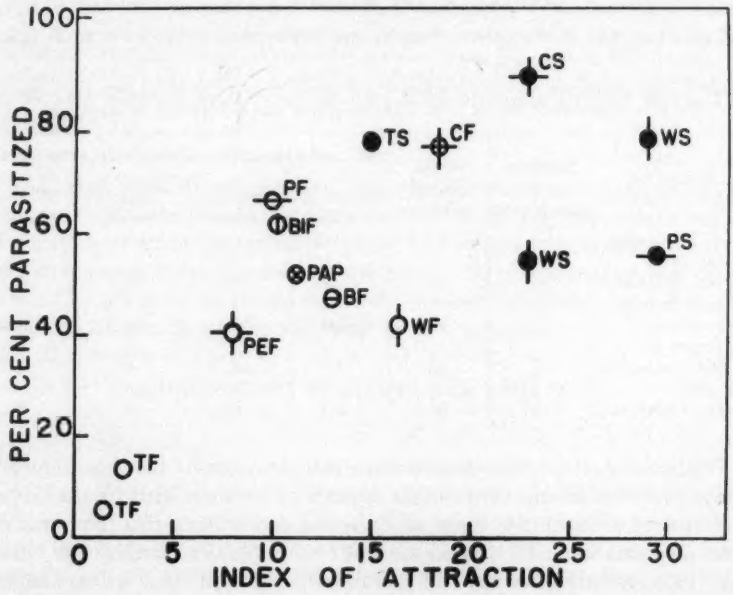

FIG. 3. Scatter diagram depicting the relationship between attraction to various media and percent parasitization by *Opius fletcheri*. The symbols used are TF, tomato fruit; TS, tomato stem; CF, cucumber fruit; CS, cucumber stem; PF, pumpkin fruit; PS, pumpkin stem; WF, watermelon fruit; WS, watermelon stem; PAP, papaya fruit; BF, balsam apple fruit; BIF, bitter melon fruit; and PEF, pepper fruit. For scientific names of these plants refer to figure 2.

tends to be non-linear. This type of relationship, which has been observed by various workers dealing with host-parasite density relationships, might be related to superparasitism and interference among females which results when too many individuals are attracted to a particular medium.

Discussion

Although the factors which determine whether or not a potential host species would be parasitized by a given parasite are complex, it is clear that the habitat of the susceptible stage of the host insect is an important factor. The importance of the habitat has been pointed out by Salt (1938) when he outlined the processes of host elimination by a given parasite. "Host habitat finding," according to Salt, is the first step in host elimination and is the one in which a majority of the potential host species are eliminated from the host list of a given parasite. This behavior of habitat finding, first reported by Picard and Rabaud in 1914, has been reported subsequently by others, among whom may be mentioned Gahan (1933), Thorpe and Jones (1937), Laing (1937), and Flanders (1940, 1953). The current study shows that *O. fletcheri* also behaves in a similar manner as that of other parasites reported in the literature. The medium in which the melon fly larvae are present is considered to be the host habitat in the present study, even though the term "host microhabitat" may be a more appropriate one.

The melon fly has a wide host range, infesting at least 36 species of plants in 12 botanical families (McBride and Tanada, 1947). Although many of these plants were not studied, it is conceivable that some would be unattractive to *O. fletcheri* and, hence, melon fly larvae infesting such plants would escape being attacked to a greater extent than those infesting attractive plants.

To determine the cause of the differences in attractiveness among media prepared from different plants or from different parts of the same plant was not within the scope of the present study. These differences are no doubt related to differences in the chemical composition, for Thorpe and Caudle (1938) have shown that certain substances present in plant tissues attract only the gravid females of *Pimpla ruficollis* Gravenhorst, a hymenopterous parasite of the pine shoot moth, *Rhyacionia* (*Evetria*) *buoliana* Schiffermüller.

It appears that attractiveness alone can not account in all cases for the differences in parasitization of larvae present in various plants observed in the field because there was a wide discrepancy between field and laboratory data. Evidently under field conditions, there are, besides attractiveness, other host elimination factors in operation about which nothing is known. In the case of the parasitization of larvae in watermelons, however, attractiveness appears to be a factor worthy of consideration. Data pertaining to the higher parasitization of larvae in the stem tissues than those in the fruit were obtained (Nishida, 1955). In the interpretation of the data it was pointed out

that such differences were due to the differences in the depth at which the larvae were present. On the basis of the present study, which showed the greater attractiveness of stem over fruit tissues, it is clear that in addition to depth, attractiveness is a factor to be considered in the interpretation of field data such as those mentioned above.

Summary

The present paper deals with an experimental study on the oviposition behavior of *Opius fletcheri* Silv., a parasite of the melon fly, *Dacus cucurbitae* Coq., established in Hawaii. It was shown that *O. fletcheri* is attracted to its host larvae by the host plant tissue rather than the larvae *per se*. Medium prepared from the tomato fruit was not attractive to the gravid females, but media prepared from other fruits such as watermelon, cucumber, papaya, pepper, and *Momordica* spp. were moderately attractive. Attraction was highest among media prepared from the stem of tomato, cucumber, watermelon, and pumpkin. Although the medium was responsible for the attraction of the parasite to the host larva, it played no role in stimulating oviposition. Oviposition was found to be stimulated by the larvae rather than the medium. In general parasitization was correlated, though not linearly, with the attractiveness of the respective medium. It was concluded that differences in the attractiveness of the media are not adequate to account for the variation in parasitization observed among larvae infesting various plants in the field.

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A New Species of Leptocera Olivier from Hawaii (Diptera: Sphaeroceridae)

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(*Presented at the meeting of October 10, 1955*)

In my paper on the Sphaeroceridae of Hawaii (PROC. HAW. ENT. SOC. 14:429, 1952) I followed Duda in using the generic name *Limosina* Macquart instead of *Leptocera* Olivier. Mr. Curtis W. Sabrosky has since written to me deploring this and stating that the type of *Leptocera* is certainly not a chloropid as Duda maintained. It is perhaps better to follow what has become normal usage and to treat *Limosina* Macquart, 1835, (=*Scotophilella* Duda, 1918) as a subgenus of *Leptocera* Olivier, 1813, the typical subgenus of the latter being equivalent to *Paracollinella* Duda, 1924.

The following species collected by Miss M. S. Adachi and Prof. D. E. Hardy appears to be new.

Leptocera (Limosina) pachypus, new species

Female. Black; top of head and especially mesoscutum and scutellum brightly shining; antennae somewhat brownish; tibiae and tarsi dark brown, first two segments of hind tarsi yellowish-brown; stalk of halteres brown. Wings hyaline with areas along the longitudinal veins, especially R_{2+3}, considerably clouded. Length 2.3 mm.

Largest bristle next to the vibrissae only one-third as long. Face gently convex, shining, no marked facial "knob," frons in side view produced considerably beyond the eyes. Top of head, except for a small anterior area on each side between the adfrontal bristles and the orbits which is rather duller, strongly shining; a single strong adfrontal bristle (as long as an ocellar) on each side. Antennae widely separated, moderately diverging, third segment a little pointed, in side view almost twice as long as broad, with rather well-developed pale pubescence, arista about six times as long as the antenna, with rather long pubescence.

Thorax with one strong humeral bristle, two posterior pairs of dorsocentrals, microchaetes in not very close irregular rows, about eight between the anterior dorsocentrals; four scutellar bristles, basal ones three-quarters as long, apicals as long as scutellum; only one very short posterior sternopleural. Fore femur rather thin, without long bristles, tibia and tarsus normal; mid trochanter without a long ascending bristle, mid femur almost without bristles except the short anterior one near apex, tibia with five anterodorsals,

the apical ones longer, four considerably shorter posterodorsals not paired with the anterodorsals, some much shorter irregular bristles between the larger ones, no mid ventral, a moderate apicoventral; basitarsus rather stout, about two-fifths as long as the tibia, ventrally with short stout oblique microchaetes, whole tarsus as long as tibia. Hind femur rather thick; it and the tibia without long bristles, tibia without a small spur, first two segments of hind tarsus considerably thickened, both a little wider than the tibia, first tarsal segment in dorsal view one and a half times as long as broad, second segment two and a third times as long as broad, a little longer than the remaining segments together. Wings (fig. 1) with basal costal bristle short, bristles along first sector of costa very short, second sector of costa about as long as first, about one and two-thirds times as long as the third, costa ending at R_5; R_{2+3} nearly straight, distally bent very gradually onto the costa; last sector of R_{4+5} at first straight, then rather strongly bent onto the costa, ending nearly as far before the wing tip as M_{1+2} does behind it; M_{1+2} produced beyond cell as a transparent fold to wing-margin, course straight and directed somewhat forwards, posterior angle of cell completely rounded; Cu_1 + 1A strongly curved, convexity anterior, not reaching the margin; alula rather narrow.

Abdomen with first two fused tergites normal, third segment large but considerably desclerotized, fourth segment very short, fifth much longer but not half as long as the third, sixth very short, these segments with very short bristles; anal split large, oval, directed somewhat upwards, surrounded by some moderately long bristles, hairs of cerci very short and woolly; sternites moderately broad and shining, with short bristles, last visible one somewhat spoon-shaped.

Male. Resembles female except as follows: size about the same; mid femur with two closely placed moderately long bristles near base ventrally, directed obliquely outwards; mid tibiae near apex ventrally with a group of about four long bristles, mid basitarsus rather shorter and stouter, dorsally flattened, a little concave beneath where the small bristles are unusually short and dense; hind trochanter with three or four stout but very short adpressed bristles, hind femur thin on basal quarter, then considerably thickened, curved down where these two parts join, base of femur beneath with one short isolated bristle, distal half beneath also with a row of short bristles, hind tibia somewhat thin at base and thickened towards apex.

Abdomen with segments three and four apparently partly desclerotized (more or less as in female), fifth segment shining, very large, longer on left side than on right. Genitalia very large, curved under the abdomen, distal part dull and shagreened, anal split large and elliptical, anteriorly directed ventral part of genitalia with a group of long dense curved bristles on each side, overlapping one another and also some long bristles on the apical sternites.

Manoa Valley, Oahu, Jan., 1952, ♀ holotype and ♀ paratype, D. E. Hardy and M. S. Adachi; same place, Feb., 1952, ♂ allotype, ♂ (headless) paratype, ♀ paratype, same collectors.

The numerous bristles on the mid tibia and the paler first two segments of the hind tarsus suggest some relationship to the subgenus *Poecilosomella* Duda. But the thorax has no grey flecks, the wing-venation is different from most *Poecilosomella* (R_1 not sharply bent), the wings are not conspicuously marked, and the legs have no clear white markings. The pointed third antennal segment is a condition found even more marked in the subgenus *Mallochella* Duda and its allies, but these differ in various ways. It appears best to regard the new species as a rather aberrant member of the subgenus *Limosina* Macquart. In Duda's key (ARCH. NATURG. 90(11):153, 1925, as *Scotophilella*) it runs rather well to *L. beckeri* Duda, which was described from Orotava in the Canary Islands. This differs, however, in having normal adfrontal bristles, quite different mid tibial bristles, R_{4+5} more sharply bent forwards distally, and the posterior corner of the cell not rounded. In Duda's later key to the same subgenus (*in* Lindner, DIE FLIEGEN DER PALAEARKTISCHEN REGION, 57:101, 1938), it also runs best to the same species but it is clearly not at all closely allied. The characters of both sexes are very peculiar and there is no reason to suppose that the species is not endemic.

The type and allotype are deposited in the Bernice P. Bishop Museum, Honolulu, Hawaii; one female paratype in the collection of the University of Hawaii; the other paratypes in my collection.

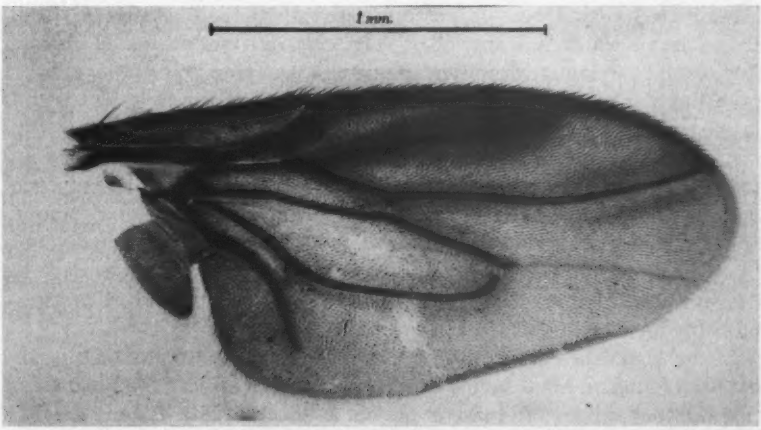

FIG. 1. *Leptocera pachypus*, n. sp. Right wing of female paratype. (Photograph by J. W. Siddorn).

Biology and Control of Araecerus levipennis Jordan (Coleoptera: Anthribidae)[1]

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(Presented at the meeting of December 12, 1955)

Koa haole, *Leucaena glauca* (L.) Bentham, is a leguminous plant introduced into Hawaii prior to 1888 (Takahashi and Ripperton, 1949). Because of its high protein content, it is a valuable forage crop and many ranches have spread its seed over rangeland. In addition to this important use, it is of some value as a raw material in the manufacture of Hawaiian seed jewelry.

During 1954 a small beetle, previously unknown in Hawaii, was found to be damaging a large percentage of the seed of koa haole (Ford and Chilson, 1955; Sherman, 1955).

Specimens were sent to the U.S. National Museum and were identified as *Araecerus* sp., evidently *simulatus* Gyllenhal. However, additional specimens sent to Dr. H. E. Karl Jordan were identified by him as *Araecerus levipennis* Jordan. This species was described from the Philippines and Cochin China (Jordan, 1924). In a letter to Dr. D. Elmo Hardy of the University of Hawaii[3] Dr. Jordan wrote, "It is a near relative of *Araecerus simulatus* Gyllenh. 1833 (Java), which is a species of very wide distribution in the Oriental Region and varying much in size and pattern. . . . *Araecerus levipennis* differs from the four other species of *Araecerus* known from the Hawaiian Islands in the following combination of distinctions: club of antennae almost symmetrical; upper side pale tawny (ochraceous) with diffuse grey spots, impressed stripes, and their punctures distinct only at sides and bases, absent dorsally from before middle to apex of elytra, which gives the elytra a smooth appearance; legs pale testaceous, tibia without dark markings; anterior tibia of ♂ hairy on underside, without teeth; sutural area sometimes dark (as happens also in *A. simulatus*). . . . The area of distribution of *A. levipennis* probably includes Indochina and Formosa."

In the Hawaiian Islands this species is abundant throughout Oahu and has been found on Maui, Kauai, and Hawaii. Jordan earlier (1946) had stated that the four species of *Araecerus* present in the Hawaiian Islands were: *A.*

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[1] Approved by the Director of the Hawaii Agricultural Experiment Station as Technical Paper No. 368.

[2] The authors are indebted to Mr. Frank H. Haramoto for the photographs used in this article.

[3] See: HARDY, D. E. Notes and exhibitions. PROC. HAW. ENT. SOC. 16 (1): 11, 1956.

constans Perkins, *A. fasciculatus* (Degeer), *A. varians* Jordan, and *A. vieillardi* (Montrouzier).

Until the arrival of *A. levipennis* the seeds of koa haole were free of any important insect pest (Sherman and Tamashiro, 1956). However, this insect, within a comparatively short time, has spread throughout Oahu where koa haole grows. The damage is caused by the grubs feeding in and completely destroying the seeds. There are times when practically 100 per cent of the seed pods in certain stands of koa haole is infested. This, of course, reduces the number of seeds available for propagation and for jewelry.

This study was undertaken to investigate the biology and control of this beetle.

Biology

Oviposition and the Egg

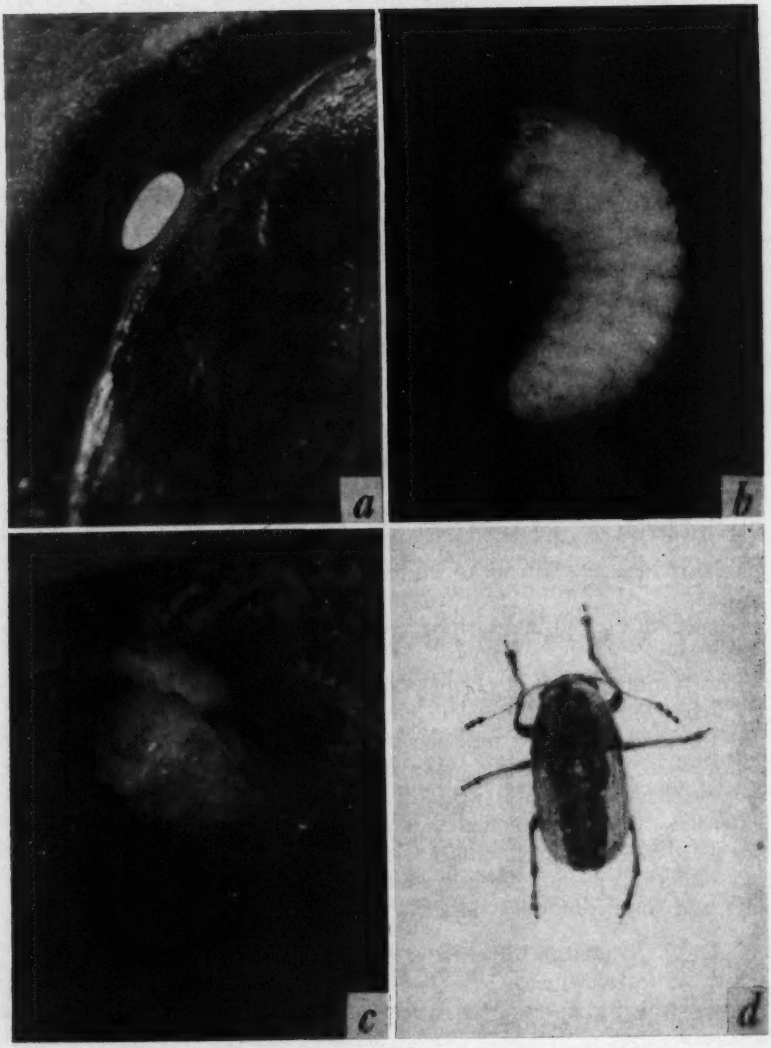
The female is selective regarding the pod in which she will deposit an egg. Only green pods which have grown to their maximum length and contain seeds which have swollen are attacked. The female, after mating, chews a hole in the pod at the swelling caused by a seed, turns around and places a single egg next to the seed (fig. 1A) through the hole she has made, then defecates over the hole. Although there is usually but one egg placed at the seed, occasionally as many as three eggs have been observed at a single oviposition site. Each seed in the pod may have an egg deposited on or near it. Sap is secreted by the pod at the points of feeding and oviposition. Damaged pods are easily detected because of the small dried globules of resin on their surface.

The egg is oval, glabrous, shiny, cream in color, and averages 0.75 x 0.30 mm. in size.

Observations were made of egg hatch between March 24 and April 8, 1955. Field-collected pairs of mating adults were taken into the laboratory and each pair was placed in a test tube together with a pod. Deposited eggs were removed daily and placed in a petri dish containing damp filter paper until they hatched. During this period a total of 238 eggs was laid. Table 1 summarizes these data. The average time for egg hatch during this period was 4.4 days. During November, 1955, egg hatch was again determined, and during this period 65 per cent hatched in four days, 25 per cent in five days, and 10 per cent in six days.

Table 1. Summary of number of days required for egg hatch. Average temperature, 75°F.

DAYS AFTER OVIPOSITION	NO. EGGS HATCHING	PER CENT HATCH
4	171	71.8
5	35	14.7
6	29	12.2
7	3	1.3


a
b
c
d

The Larva

The larva (fig. 1B) is a crescent-shaped, cylindrical, cream-colored, legless grub. The newly hatched larva remains outside the seed while feeding, but within a day or so bores into the seed at the point where the egg was laid. It feeds on the embryo tissues, leaving the seed coat intact except for the entry site. As the larva matures the entire embryo is consumed, and prior to pupation the mature larva constructs a pupal chamber within the seed. The seed is usually hollowed out so that only the edges of the seed coat remain. The chamber is then sealed with frass. Within this chamber the mature larva becomes a prepupa, its body constricts, and the digestive tract is cleared prior to pupation.

Number of Instars

Dyar's Rule (Dyar, 1890) has been helpful in determining the number of instars in insect larvae which feed hidden within plant tissues. Although this rule, which states that the head widths of the larvae follow a geometrical progression in successive instars, was originally developed from observations on lepidopterous larvae, it has since been extended to include other insect groups. For this study, the method described by Sherman and Tamashiro (1954) in determining the number of instars in sweet potato weevil larvae was used. Infested pods containing larvae in all stages of development were brought into the laboratory. Infested seeds were opened and the larvae removed, killed in hot water, and preserved in 75 per cent alcohol. The larvae were decapitated, the heads mounted on a microscope slide in Hoyer's solution (Baker and Wharton, 1952) and their widths measured.

A total of 1,137 head widths was determined. The frequency distribution of the measured larval head widths is given in figure 2. The distribution fell into three distinct groups and each group was assumed to be an instar. This assumption was analyzed statistically by the method of least squares as described by Gaines and Campbell (1935). The results of the analysis are summarized in table 2.

A geometrical progression may be plotted graphically as a straight line by the equation: $\log y = \log a + x \log b$, where y is the width of the head capsule, a and b are constants, and x is the number of the instar. Any deviation of observed values from the calculated line would indicate variation from the geometric progression. The regression line calculated as the best fit for the geometrical growth of the larvae of *A. levipennis* was $\log y = 0.2610 + 0.1994x$.

The observed mean head widths of the assumed instars were plotted as suggested by Forbes (1934) and Harries and Henderson (1938). The similarity

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FIG. 1. The stages of *Araecerus levipennis* Jordan. *a*, the egg, adjacent to a koa haole seed; *b*, the larva; *c*, the pupal chamber uncovered, showing the pupa; *d*, the adult.

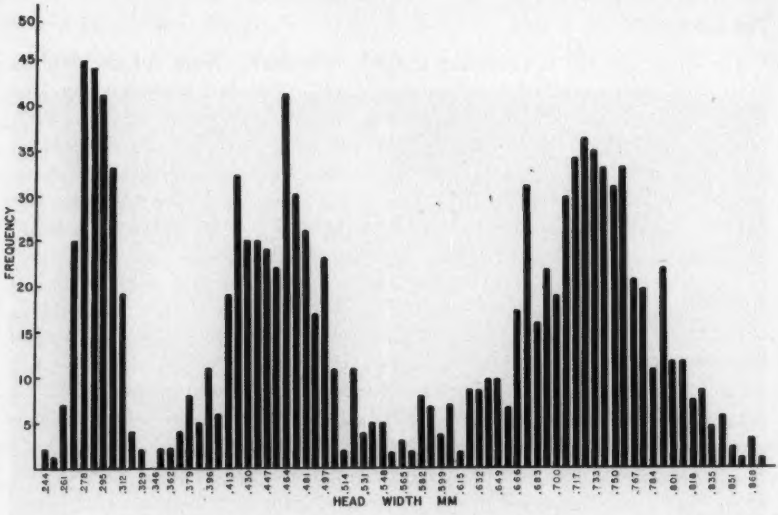

FIG. 2. Frequency distribution of the head widths of larvae of *Araecerus levipennis* Jordan.

between observed and calculated values corroborated statistically the number of instars in the larval stage.

TABLE 2. Head measurements of larvae of *Araecerus levipennis* Jordan.

MEASUREMENT	LARVAL INSTAR		
	I	II	III
Observed mean head width (mm.)	0.289±0.013	0.456±0.040	0.724±0.063
Log value (×10)	0.46090	0.65896	0.85974
Calculated mean head width (mm.)	0.28870	0.45695	0.72322
Log value (×10)	0.46045	0.65987	0.85929
Growth ratio (observed)	.....	1.578	1.588
Growth ratio (calculated)	.....	1.583	1.583
Number measured	223	362	552
Size range (mm.)	0.244–0.337	0.354–0.556	0.565–0.877

Duration of Stadia

An experiment was conducted in the fall of 1955 to determine the length of time spent in the larval stage. On November 1, thirteen ripening pod clusters were bagged in polyethylene bags. These bags were punctured with fine holes, too small to allow the entry of the adult beetle, but large enough to allow for aeration and drainage of water of transpiration. On November 18, field-collected adults were placed in the bags for approximately 24 hours and then removed. Egg deposition was high in most of the pods. A number of pods were taken into the laboratory to determine the hatching period.

The eggs hatched in four to six days. When egg hatch was completed, a polyethylene-bagged pod cluster was brought into the laboratory, several pods opened and the larvae taken from within the seeds. The rest of the pods were resealed in the bag. When the pods were all dissected, another bag was brought in from the field for examination until eventually all of the bagged pods were inspected. The larvae which were removed from the seeds were killed in hot water and stored in 75 per cent alcohol. The larvae were removed from the pods over a period of 53 days. They were decapitated and the larval instar was determined from the head width measurements.

The number of days after oviposition on which the various instars were found is as follows: first, 4 to 12 days; second, 10 to 31 days; and third, 17 days to the end of the observation period. Pupae were first found 40 days after oviposition; however, on that same day an adult that was at least 2 days old was also discovered. It appears, therefore, that the minimum number of days required for the larval period was 27 days and that the minimum number of days spent within each instar was: first, 6; second, 7; and third, 14.

In connection with the control experiments described below, pods which were placed in cloth-covered jars so that no later oviposition could occur yielded living third-instar larvae. In one case a third-instar larva was found in a seed that had been sealed for 211 days. In several other jars that had been sealed for 180 days 12 living third-instar larvae were found. In these instances the seeds were extremely dry and hard.

The pods which were used in this larval duration study were green and succulent until December 15, 1955, when they began to dry and harden. The bagged infested pods which were brought into the laboratory after that date showed evidence of a high degree of oviposition, and most of the seeds were damaged; yet the seeds yielded very few living larvae. Instead, many dessicated larvae were found. In these instances the second- and third-instar larvae that were usually to be found feeding inside the seed were lying in the pod outside of but adjacent to the seed. The seeds showed evidence of deep feeding and it seemed as though the larvae had been forced out of the seeds. Some of the larvae seemed to be diseased, yet no definite disease organism was found in specimens taken to Dr. Y. Tanada of the University of Hawaii. They were semi-flaccid, exhibited little or no activity, and were definitely moribund.

The Pupa

The pupa (fig. 1C) has the shed larval skin attached to the tip of its abdomen, and the larval head capsule is especially distinct. The pupa is approximately 4.0 mm. long and 1.8 mm. wide.

The duration of the pupal period was determined in the laboratory. Mature larvae in seeds were placed individually in test tubes which were sealed and stored in a darkened box. Daily observations were made and the dates on which the pupa and finally the adult was formed were recorded. Table 3

summarizes the number of days required for pupation by the male and female beetle. The male beetle averaged 7.8 days, while the female averaged 7.4 days.

TABLE 3. Summary of number of days required for pupation.

PUPAL PERIOD (days)	NO. OF PUPAE	
	♂	♀
6	2	3
7	12	20
8	3	11
9	4	4
10	2	0
11	1	0

Pigmentation of the pupa could be associated with age as follows: first to third day, the entire body cream colored, the eye when viewed laterally containing a black spot; fourth day, the eye facets light brown; fifth day, the eye facets well defined and brown and the tips of the mandibles brown; sixth day, the body turning light brown, the prothorax dark brown, the eyes very dark brown, mandibles completely brown, and the posterior half of the elytra grey; seventh day, the head and prothorax dark with the prothoracic margin black, eyes black, legs brown, and the antennae brown with three grey terminal segments. The teneral adult is reddish brown in color.

The Adult

The adult (fig. 1D) is dark brown and usually bears two broad grey elytral stripes of short scale-like setae that extend somewhat less distinctly along the prothorax. Occasionally the stripes are missing and the elytra have a speckled appearance. The adult ranges in length between 2.5 and 4.4 mm. when measured in dorsal aspect from the anterior margin of the pronotum to the tip of the pygidium.

In a preliminary attempt to determine the sex ratio, 236 field-collected adults were separated by sex into 133 ♀♀ and 103 ♂♂. The sexes could easily be distinguished from one another by examination of the pygidium which in the male has a rounded apex, while in the female it is longer and has a pointed apex. Mating is most active during the late morning hours.

The adults feed on the pods and also the pedicel of the pod where they strip the bark to the cambium. They cause no important direct damage by their feeding; it is the larval stage that is most damaging. The holes they chew in the pods are similar to those produced during oviposition. Probably during the period of oviposition the females obtain much of their nutritional requirements in preparing the oviposition sites.

The tolerance of the adult to starvation was investigated. Mature pupae were placed in individual test tubes that were sealed with cotton plugs. The adults that emerged were kept from food and water, and observations were

made daily until death of the adult occurred. The average survival time of 50 individuals was 17.7 ± 4.6 days.

The adults are good fliers. They are often reluctant to fly, however, and can be picked up by hand when they are actively feeding or ovipositing. This may account, in part, for the poor distribution of adults often observed in the field. It was commonly found, when sweeping for adults in a koa haole thicket alongside a road, that certain spots yielded more adults than others. This occurred despite the apparent similarity of growth of the koa haole and development of the seed pods. The damage to the pods, however, appeared to be much more uniform.

Control

Natural Control

The physical condition of the koa haole seed appears to affect the development and maturation of the beetle. It has been observed that drying pods with hardening seeds slowed down the development of the larvae, and also under such conditions many larvae were found to be dead or dying. As mentioned earlier, it is not known whether some unknown disease organism had attacked the larvae or whether this condition was due to starvation. However, in numerous instances the pods showed external evidence of a high incidence of infestation, but when opened no living larvae were found although the seeds were damaged by feeding. This was also observed in the bagging experiments described below, where infested pods were taken into the laboratory and placed in cloth-covered jars. Upon examination five months later few adults had emerged, although in some instances the original infestation was high.

A predacious mite, *Pyemotes* (=*Pediculoides*) *ventricosus* (Newport), appears to be another important factor in reducing the beetle population. It feeds on the larvae, pupae, and teneral adults of *A. levipennis*. However, its effectiveness is probably restricted since it will attack the beetle only in mature dry seed pods.

Of negligible importance from a control standpoint is the hymenopterous parasite *Eupelmus cushmani* (Crawford), only four specimens of which were reared from infested seeds.

Chemical Control

Since most of the koa haole grows wild, it would be difficult to control the beetle by conventional insecticide spraying methods. It might be possible to apply these control methods, however, where the koa haole was planted in a grove for the purpose of producing beetle-free seed. For the seed jewelry manufacturers, on the other hand, another method would have to be used, since they usually obtain their seed from plants growing along the roadside. In this regard, the practicability of insecticide dip treatment was investigated.

Mature green seeds were removed from field-infested pods, placed on cheesecloth, and dipped into an insecticide slurry until they were well wetted. The treated seeds were dried, placed in glass jars that were sealed with cloth, and held for a period of six months. Five insecticides were used in this experiment: DDT as a wettable powder, and lindane, aldrin, dieldrin, and malathion as emulsifiable concentrates. All insecticide treatments were replicated four times. During the storage period, frass was produced by the larvae not killed by the treatments. The effectiveness of the dip treatment was estimated by the amount of frass produced in the jars during storage.

The seeds that received no insecticide treatment were approximately 27 per cent infested. Lindane at 0.001 per cent, aldrin at 0.05 per cent, and dieldrin at 0.05 per cent showed no evidence of post-treatment feeding. However, DDT at 0.25 per cent and malathion at 0.10 per cent showed evidence of post-treatment feeding.

In connection with dip treatment it is important that the seeds, especially the green moist seeds, be dried to prevent damage by fungi during storage.

Boiling

In the manufacture of koa haole seed jewelry the dried seeds are boiled to soften them before stringing. This suggested the possibility of boiling the mature green seeds prior to their being greatly damaged by the grubs. Infested pods that contained mature green seeds or seeds beginning to dry were collected. The seeds were removed from the pods and placed in boiling water for 10 seconds, 30 seconds, 1 minute, and 3 minutes. The seeds were then dried and placed in jars that were sealed with cloth. Unfortunately, although the larvae were killed, the hot water treatment fixed the green color in the seeds and prevented their natural browning. It appears, therefore, that the use of the hot water treatment would be restricted to drying brown seeds.

Bagging

It was felt that bagging the pods might prove to be one of the least expensive methods of protecting the seeds from beetle attack. An investigation was initiated to determine the feasibility of this method and the types of materials that could be used.

The use of three types of bags was explored[4]: (a) 20-pound kraft paper bags, (b) 25-pound multilined paper fertilizer bags, and (c) thin polyethylene bags. Uninfested pod clusters in various stages of development were enclosed within these different types of bags. Clusters of pods of similar age were marked and left unbagged to serve as checks.

The bagging procedure was as follows: the branch on which the pod cluster was to be bagged was first stripped of all of its leaves. Nearby branches,

[4] The authors wish to thank the Pacific Chemical and Fertilizer Co., Honolulu, Hawaii, and the Honolulu Paper Co. for their donation of the fertilizer bags and polyethylene bags, respectively.

which could possibly come in contact with the bags and rip them, were removed. The bag was slipped over the cluster in such a manner that the pods were in their normal position and the open end was closed with string. It was necessary to puncture the polyethylene bags with a series of tiny holes to allow for drainage of the water of transpiration and to allow for aeration and cooling. It was found that if this were not done there was an accumulation of considerable amounts of water within a few days. It was not necessary to puncture either type of paper bag.

The pod clusters were bagged on March 12, 1955, and weekly observations were made of the condition of the bags and the pods. The pods were collected between May 3 and June 2, 1955, taken into the laboratory, and held in sealed jars until November 28–29, 1955, when the final observations were made.

The 20-pound kraft paper bags soon proved impractical. Within a month the bags were so badly torn that no protection was afforded the pods, and these were badly infested.

All but one polyethylene bag withstood the weathering period of 10 weeks. The one damaged bag had three slight 2-inch tears along a crease. The seeds in the pods that were very young when bagged developed normally. No infestation occurred. All the seeds were of good size, shape, and color and were good material for jewelry.

None of the fertilizer bags was intact at the end of 10 weeks. One bag was punctured and badly torn; the pods were slightly moldy, but the seeds were uninfested and in good condition. The other six bags had all come apart at the seam. Apparently the bags were put together with a non-waterproof glue and rain water had caused the seams to separate. Despite this, an examination of the seeds in four of the bags showed excellent color and shape and no damage. The other two bags yielded a total of 36 pods, containing 407 seeds, of which 9.1 per cent was infested. Thirteen adult beetles emerged during the storage period.

The unbagged clusters contained 81 pods. An examination of 1,236 seeds showed a mean infestation of 43.4 per cent with a range of 13.0 to 98.5 per cent. Thirty-six adult beetles emerged during the storage period and 13 living third-instar larvae were found.

Bagging the pods, therefore, affords good protection from attack by the beetle provided the bags are such that they will withstand several months of weathering. No adverse effect upon the growth and maturation of the seeds was noted.

Summary

The biology and control of *Araecerus levipennis* Jordan was investigated. This recently introduced beetle destroys the seed of koa haole, *Leucaena glauca* (L.) Bentham.

The egg, which is usually laid singly through the pod so that it contacts the seed, hatches in 3 to 7 days.

There are three larval instars and the larval period ranges from 27 to over 211 days.

Pupation occurs within the seed. The pupal period varies from 6 to 11 days.

The adult is dark brown and usually has two broad grey elytral stripes that extend along the prothorax. Occasionally the stripes are missing and the elytra have a speckled appearance.

Drying pods with hardening seeds slowed down the development of the larvae, and in some instances under such conditions many larvae were found dying or dead. A predatory mite, *Pyemotes ventricosus* (Newport), was found destroying large numbers of larvae, pupae, and teneral adults in several localities in Manoa Valley.

Conventional insecticide spraying is impractical since koa haole is not usually grown in planned groves. Studies on seed treatment with insecticide dips and by boiling are described.

Enclosing ripening koa haole pods within polyethylene bags prevented damage by this insect.

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An Annotated List of Infectious Diseases of Insects in Hawaii. Part II.[1, 2]

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(*Presented at the meeting of December 12, 1955*)

Since the presentation of the first list of infectious diseases of insects in Hawaii at the Eighth Pacific Science Congress in 1953 (Tanada, in press), a substantial number of additional diseases have been recorded and it was thought desirable to compile a second list. The supplementary list presented here includes records from recent observations and references that were omitted from the first list. The names of the collectors of the diseases newly recorded in Hawaii are given in the table.

No new bacterial pathogen was observed during 1954–1955 in Hawaii. However, the writer conducted laboratory and field tests with *Bacillus thuringiensis* Berliner which was found infectious for the diamond back moth, *Plutella maculipennis* (Curtis), the cabbage webworm, *Hellula undalis* (Fabricius), and the cabbage looper, *Trichoplusia ni* (Hübner). The first species was much more susceptible to the bacterium than were the latter two species.

In the summary of his study on Hawaiian fungi, Bessey (1943) notes that only three species of Entomophthoraceae had been reported from Hawaii at that time. These three are all in the genus *Entomophthora* and were included in the first list. Recently two species of entomophthorous fungi, *Empusa aphidis* Hoffman and *E. muscae* Cohn, that are cosmopolitan in distribution, were found in Hawaii. Mr. F. Bianchi in January, 1953, observed colonies of sugar cane aphid, *Aphis sacchari* Zehntner, killed by a fungus at Mountain View, Hawaii. This fungus was identified by Dr. M. L. Lohman of the University of Hawaii as *Empusa aphidis*. *Empusa muscae* was found in January, 1954, by the writer on houseflies (*Musca domestica* L.) collected on a metal clothesline at his home on the University of Hawaii campus in Honolulu. This fungus was identified by Dr. E. A. Steinhaus of the University of California, Berkeley. Throughout 1955, Mrs. Edna Tanada has diligently collected from her clothesline houseflies killed by the fungus. She found 14 dead flies in March, 29 in May, 9 in June, 22 in July, 2 in August, 2 in

[1] Approved by the Director of the Hawaii Agricultural Experiment Station as Technical Paper No. 366.

[2] I wish to thank Dr. M. L. Lohman of the University of Hawaii for checking the taxonomic names of the fungi.

September, 58 in October, 57 in November, and 16 in December. These records indicate that the fungus is active throughout the year.

Although in recent years there has been some doubt as to the pathogenicity of fungi in the genera *Sphaerostilbe*, *Torrubiella*, *Nectria*, and *Ophionectria* (Holloway and Young, 1943; Fisher, 1950), those recorded from Hawaii are included in the present list, since they have not been definitely proved non-parasitic. These fungi were listed by both Stevens (1925) and Parris (1940). Some of Steven's information was from unpublished records of O. H. Swezey.

In the first list, five species of scales were recorded as hosts of the white-halo fungus, *Verticillium lecanii* (Zimmerman). The writer found another scale, *Saissetia hemisphaerica* (Targioni—Tozzetti), parasitized by this fungus in Hilo, Hawaii, in March, 1953.

The number of hosts parasitized by the ubiquitous fungus *Beauveria bassiana* (Balsamo) Vuillemin is increasing each year. Mr. H. K. Nakao of the Territorial Board of Agriculture and Forestry noticed in February, 1954, that some of the larvae of *Blepharomastix acutangulalis* (Snellen) in his laboratory culture were attacked by a fungus, which was identified by the writer as *B. bassiana*. Field specimens of the nutgrass armyworm, *Laphygma exempta* (Walker), the housefly, *Musca domestica*, and the carpenter bee, *Xylocopa varipuncta* Patton, were also found infected by a fungus that was determined by the writer to be *B. bassiana*. The writer collected the specimens of *L. exempta* at Piikea, Hawaii, in March, 1954. The housefly was collected by Mrs. Tanada on her clothesline in November, 1955. This specimen had a bloated abdomen which was light red in color. It was kept overnight in a tightly stoppered vial at room temperature. The next morning the fly was almost completely covered by a white fungus mycelium. Mr. R. H. Van Zwaluwenburg brought in the fungus-infected carpenter bee which was collected in November, 1955, at Kailua, Oahu, by a student, H. J. Vaspra.

Species of *Sporotrichum* and *Botrytis* were listed by Stevens (1925) and Parris (1940) as parasites of Hawaiian insects. Parasitic fungi listed in these two genera are often species of *Beauveria* according to MacLeod (1954).

Speare (1912*a*) reported a *Cordyceps* sp. (probably *Isaria Saussurei* Cooke) as a parasite of *Polistes* sp.; however, in 1920, he revised his identification and called the fungus *Hirsutella Saussurei* (Cooke) Speare. He also described in 1920 two new species, *Hirsutella fusiformis* Speare on crickets and *H. citriformis* Speare on two homopterous insects, *Perkinsiella saccharicida* Kirkaldy and *Siphanta acuta* (Walker). The *Isaria* sp. reported by Van Dine (1904) on the above two homopterous insects is probably *H. citriformis*.

Corn aphids, *Aphis maidis* Fitch, killed by a fungus were collected by Mr. H. I. Rainwater at Mokuleia, Oahu, in 1955. This fungus was identified by Dr. C. G. Thompson of the Entomology Research Branch, U.S.D.A., as *Acrostalagmus* sp., probably *aphidum* Oudemans.

TABLE 1. Infectious diseases of insects in Hawaii. This list supplements the first list presented at the Eighth Pacific Science Congress in 1953.

TYPE OF INFECTION	PATHOGEN	HOST	LABORATORY OR FIELD INFECTION	COLLECTORS OR REFERENCES
Bacterial	*Bacillus thuringiensis* Berliner	*Plutella maculipennis* (Curtis)	Laboratory and field (artificial)	Y. Tanada
		Hellula undalis (Fabricius)	Laboratory and field (artificial)	Y. Tanada
		Trichoplusia ni (Hübner)	Laboratory and field (artificial)	Y. Tanada
Bacterial	*Serratia marcescens* Bizio	*Dacus dorsalis* Hendel	Laboratory	Steinhaus, 1951
Fungus	*Empusa muscae* Cohn	*Musca domestica* L.	Field	Y. Tanada
Fungus	*Empusa aphidis* Hoffman	*Aphis sacchari* Zehntner	Field	F. Bianchi
Fungus	*Sphaerostilbe coccophila* Tulasne	Superfamily Coccoidea	Field	Carpenter, 1920
Fungus	*Torrubiella* sp.	*Omiodes accepta* (Butler)	Field	Stevens, 1925; Parris, 1940
Fungus	*Nectria subcoccinea* Saccardo and Ellis	Superfamily Coccoidea	Field	Stevens, 1925; Parris, 1940
Fungus	*Ophionectria coccicola* (Ellis and Everhart) Berlese and Voglino	*Lepidosaphes beckii* (Newman)	Field	Stevens, 1925; Parris, 1940
Fungus	*Verticillium lecanii* (Zimmerman)	*Saissetia hemisphaerica* (Targioni-Tozzetti)	Field	Y. Tanada
Fungus	*Beauveria bassiana* (Balsamo) Vuillemin	*Cylas formicarius elegantulus* (Summers)	Laboratory	Sherman, 1952

TABLE 1.—(*Continued*) Infectious diseases of insects in Hawaii. This list supplements the first list presented at the Eighth Pacific Science Congress in 1953.

TYPE OF INFECTION	PATHOGEN	HOST	LABORATORY OR FIELD INFECTION	COLLECTORS OR REFERENCES
		Euscepes postfasciatus (Fairmaire)	Laboratory	Sherman, 1952
		Pieris rapae (L.)	Field	Tanada, 1955*c*
		Blepharomastix acutangulalis (Snellen)	Laboratory	H. K. Nakao
		Laphygma exempta (Walker)	Field	Y. Tanada
		Musca domestica L.	Field	Mrs. E. Tanada
		Xylocopa varipuncta Patton	Field	H. J. Vaspra
Fungus	*Sporotrichum* sp. ? (=*Beauveria* sp.)	*Semnoprepia* sp.	Field	Stevens, 1925; Parris, 1940
Fungus	*Sporotrichum* sp. ? (=*Beauveria* sp.)	*Genophantis* sp.	Field	Stevens, 1925; Parris, 1940
Fungus	*Botrytis grassi*?	*Adoretus sinicus* Burmeister	Field	Stevens, 1925; Parris, 1940
		Anomala orientalis (Waterhouse)	Field	Stevens, 1925; Parris, 1940
		Oxydema fusiforme Wollaston (=*Pseudolus hospes* Perkins)	Field	Stevens, 1925; Parris, 1940
		Polytus mellerborgi (Boheman) (=*Calandra remota* Sharp)	Field	Stevens, 1925; Parris, 1940
		Stenommatus muscae Marshall	Field	Stevens, 1925; Parris, 1940

TABLE 1.—(*Continued*) Infectious diseases of insects in Hawaii. This list supplements the first list presented at the Eighth Pacific Science Congress in 1953.

TYPE OF INFECTION	PATHOGEN	HOST	LABORATORY OR FIELD INFECTION	COLLECTORS OR REFERENCES
		Scolytidae	Field	Stevens, 1925; Parris, 1940
Fungus	*Hirsutella Saussurei* (Cooke) Speare (=*Isaria Saussurei* Cooke)	*Polistes* sp.	Field	Speare, 1920
Fungus	*Hirsutella citriformis* Speare	*Perkinsiella saccharicida* Kirkaldy	Field	Speare, 1920
		Siphanta acuta (Walker)	Field	Speare, 1920
Fungus	*Hirsutella fusiformis* Speare	Gryllidae	Field	Speare, 1920
Fungus	*Acrostalagmus* sp. prob. *aphidum* Oudemans	*Aphis maidis* Fitch	Field	H. I. Rainwater
Fungus	*Fusarium moniliforme* Sheldon	*Syagrius fulvitarsis* Pascoe	Field	Parris, 1940
Virus	*Borrelina* sp.	*Pseudaletia unipuncta* (Haworth)	Field	Tanada, 1955*a*; Davis, 1955
Virus	*Borrelina* sp.	*Blepharomastix acutangulalis*	Laboratory	H. K. Nakao
Virus	*Borrelina* sp.	*Vanessa cardui* (L.)	Field	Y. Tanada
Virus	*Borrelina* sp.	*Catabena esula* Druce	Laboratory	H. K. Nakao
Virus	*Bergoldia* sp.	*Pseudaletia unipuncta*	Field	Tanada, 1955*a*
Protozoan	*Perezia mesnili* Paillot	*Apanteles glomeratus* (L.)	Field	Tanada, 1955*b*
Protozoan	Microsporidia	*Hellula undalis*	Field	Y. Tanada
Protozoan	Microsporidia	*Blepharomastix acutangulalis*	Laboratory	H. K. Nakao

Stevens (1925) and Parris (1940) referred to Speare (1912*b*) as having listed the following four insects as hosts of *Metarrhizium anisopliae* (Metchnikoff) Sorokin: *Conoderus exsul* (Sharp) (=*Monocrepidius exsul* Sharp), *Pantomorus godmani* (Crotch) (=*Pantomorus fulleri* Champion), *Gonocephalum seriatum* (Boisduval), and *Plusia chalcites* (Esper). However, the writer was unable to find these four species listed as hosts of *M. anisopliae* in Speare's publication, and so they have not been included in the present list.

The first list presented in 1953 contained only two determined virus diseases of insects in Hawaii; the present list includes five additional viruses —four in the genus *Borrelina* and one in the genus *Bergoldia*. This is the first record of the following three *Borrelina* spp. in Hawaii. Two of the *Borrelina* spp. were observed in the laboratory by Mr. Nakao in larvae of *Blepharomastix acutangulalis* in March, 1954, and in larvae of *Catabena esula* Druce in July, 1955. The viruses were identified by Dr. Steinhaus and Mr. K. M. Hughes of the University of California, Berkeley. The polyhedra of a *Borrelina* sp. were found by the writer in infected and dead larvae of the painted lady, *Vanessa cardui* (L.), collected at Kohala, Hawaii, in May, 1955. An outbreak of this insect was defoliating the wild thistle growing on the rangeland.

Two new records of protozoan diseases are included in the present list. A microsporidian was observed within larvae of the cabbage webworm, *Hellula undalis*, collected in the field at the University of Hawaii in August, 1953. Mr. Nakao noticed in March, 1954, a microsporidian in laboratory-reared larvae of *Blepharomastix acutangulalis*. Neither of these microsporidians has yet been identified to species.

Summary

This list of infectious diseases of insects in Hawaii supplements the list that was presented at the Eighth Pacific Science Congress in 1953. It includes approximately 26 pathogenic microorganisms and 40 insect hosts. Sixteen of the records have not been recorded previously in Hawaii.

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Size of a Granulosis Virus of Pieris rapae (L.)

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(Presented at the meeting of December 12, 1955)

A granulosis virus, *Bergoldia virulenta* Tanada, which attacks the imported cabbageworm, *Pieris rapae* (L.), was described in 1953 (Tanada, 1953). Smith and Xeros (1954) in their review of this paper remarked: "Tanada states that there was a great variation in the width of the virus rods (40–100 mμ). It is clear from the published pictures, however, that this huge variation is not entirely due to variations in the width of the virus rods themselves, but that the virus particles are about 40 mμ wide, and those bodies taken as very wide rods by Tanada are virus rods still surrounded by their inner capsules, and having a diameter of about 90 mμ."

It should be pointed out that Smith and Xeros extracted the above measurements of the virus rods or particles out of context and did not quote the final measurements given in my paper. They also failed to mention that an adequate explanation, similar to theirs, was given for the great variations in the size of the virus particles as indicated by the following quotation from my paper (p. 242): "In 286 particles examined, the width ranged from 41 to 100 millimicrons, while the length ranged from 221 to 290 millimicrons. Most of the virus particles ranged within 61 to 90 millimicrons by 231 to 270 millimicrons. Apparently these fairly thick virus rods were enclosed in a membrane which has been called the 'spherical membrane' by Bergold (1950)." Thus, the greater thickness of the broad rods was attributed to the spherical membrane, which Smith and Xeros designated as "inner capsule." In the next paragraph, I mentioned the presence of distinctly thinner virus particles, and an electron micrograph showing these thin particles was presented (fig. 3C, p. 243). Again, quoting from my paper: ". . . the virus particles were not only distinctly thinner, but some of the particles had the spherical membranes attached to them (Fig. 3C). Occasionally what appeared to be empty collapsed membranes could be seen. The size of these naked particles ranged from 31 to 60 millimicrons in width and 191 to 340 millimicrons in length, with most of them being 41 to 50 millimicrons by 291 to 300 millimicrons." In the summary, the measurement of the free virus particles was given only as 41 to 50 millimicrons by 291 to 300 millimicrons. Thus, the variation in width both with and without the spherical membrane of 41 to 100 millimicrons was given just once in the paper, the presence of

the membranes on the broad particles was reported, and the range of 41 to 50 millimicrons was given as the actual width for the free virus particles. Bergold (1953) correctly quoted the measurement of 41–50 x 291–300 millimicrons from my paper.

Most authors present the size of virus particles as an approximate average. It is obvious that exact figures could not be given for the size of virus particles because of: (i) inherent variations in the size of the virus particles, (ii) some variations in the size of the polystyrene particles used as a standard, (iii) errors in measurements, (iv) errors inherent in the electron microscope, and (v) distortions which arise during the preparation of the virus particles for electron microscopy. With these possible sources of error in mind, I had decided to represent the size of the virus particles within a range of 10 millimicrons which included the mean. Possibly, it would have been better still to have presented the mean and its standard error.

From my original measurement of the 191 naked virus particles, I have now calculated their average width and length. The mean width was 46.9 millimicrons with a standard error of ± 7.5 millimicrons, and the mean length was 293.6 millimicrons with a standard error of ± 23.7 millimicrons. When enclosed in the spherical membrane (inner capsule), the mean width of 286 virus particles was 75.1 millimicrons with a standard error of ± 6.7 millimicrons, and the mean length was 248.1 millimicrons with a standard error of ± 11.6 millimicrons. As I had explained in my paper, the virus particle when enclosed within the spherical membrane is usually slightly curved and therefore appears shorter than the free particle. Bergold (1953) has also isolated the naked virus particles of *B. virulenta* and his measurements were 42 x 268 millimicrons.

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A New Genus of Psyllidae from Hawaii (Homoptera)

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(*Presented at the meeting of March 15, 1955*)

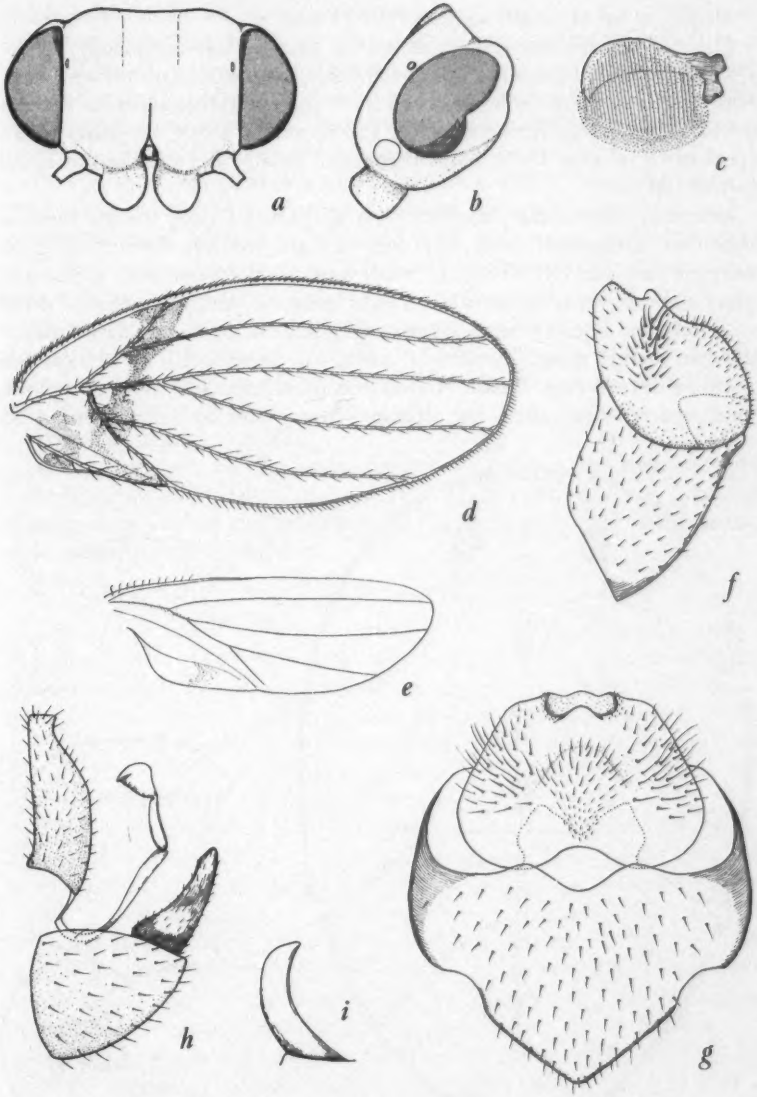
In the summer of 1952 Dr. H. A. Bess found a psyllid breeding in some abundance on *Fagara dipetala* (Mann) Engler near Kilauea Crater, Hawaii. Examination of the specimens shows them to be an undescribed species which is so distinct structurally that a new genus is erected for it. The species described as *Hevaheva aloha* by Caldwell (PROC. HAW. ENT. SOC. 10(3):394, 1940), taken on Kauai by O. H. Swezey, is of similar structure and is transferred to the new genus. Both species have host plants belonging to the genus *Fagara* or *Zanthoxylum*. It is probable that additional species will be found to occur on *Fagara* on the islands lying between Kauai and Hawaii.

Hemischizocranium, new genus

Head, thoracic dorsum, veins of forewing, legs, and genital segments with many prominent setae. Head much narrower than mesonotum. Vertex flat discally, strongly rounded down laterally, anterior margin bulgingly rounded to genae, medial suture incomplete, extending from frons 0.3 to 0.5 distance to caudal margin. Genae produced as short, blunt processes, not contiguous, much shorter than vertex, set distinctly below plane of vertex. Eyes small, rounded, set far back on head. Antennae shorter than body. Thorax quite flat dorsally. Pronotum very short, extending far caudad laterally. Forewings broadly rounded apically; basal vein very short; R arising from basal vein shortly before M and Cu; Cu with short petiole; both marginal cells elongate; Rs long, nearly straight; no distinct pterostigma present. Legs long. Metacoxa very short, without meracanthus. Metatibia without basal armature, with continuous row of heavy black apical spines, not protruding from plane of tibia. Proximal segment of metatarsus without claws. Apical segment of all tarsi seemingly without claws; high magnification shows very small claws to be present, lightly sclerotized and highly modified, with large ventral pad.

Type of genus: *Hemischizocranium bessi*, new species.

FIG. 1. *Hemischizocranium bessi*, n. sp. *a*, cephalic aspect of head; *b*, lateral aspect of head; *c*, detail of tarsal claw; *d*, fore wing; *e*, hind wing; *f*, lateral aspect of female cauda; *g*, caudal aspect of female cauda; *h*, lateral aspect of male cauda; *i*, caudal aspect of male clasper.


a
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Hemischizocranium bessi, new species

Length to tip of folded wings 3.75–4.25 mm.

Color: General color yellow. Abdomen more or less completely brown. (In highly colored specimens thorax and head also with dark brown areas). Forewings with irregular brown band from point of clavus across to costa at tip of R_1, including furcation of Cu and R, several small, irregular, brown spots in claval area. Hind wings pigmented along basal vein and in apical half of clavus.

Structure: Prominent pubescence on all parts of body except thoracic venter and abdominal terga, very long on head, thoracic dorsum and forewings. Head strongly deflexed, nearly vertical, narrower than pronotum, much narrower than mesonotum. Vertex quite flat, strongly rounded down anteriorly and laterally, with slight longitudinal sulci, caudal margin nearly straight, medial suture obsolete in caudal 0.6, lateral ocelli on vertical side portions next to eyes. Genae produced as blunt processes, not contiguous, much shorter than vertex, not separated from vertex by suture, completely

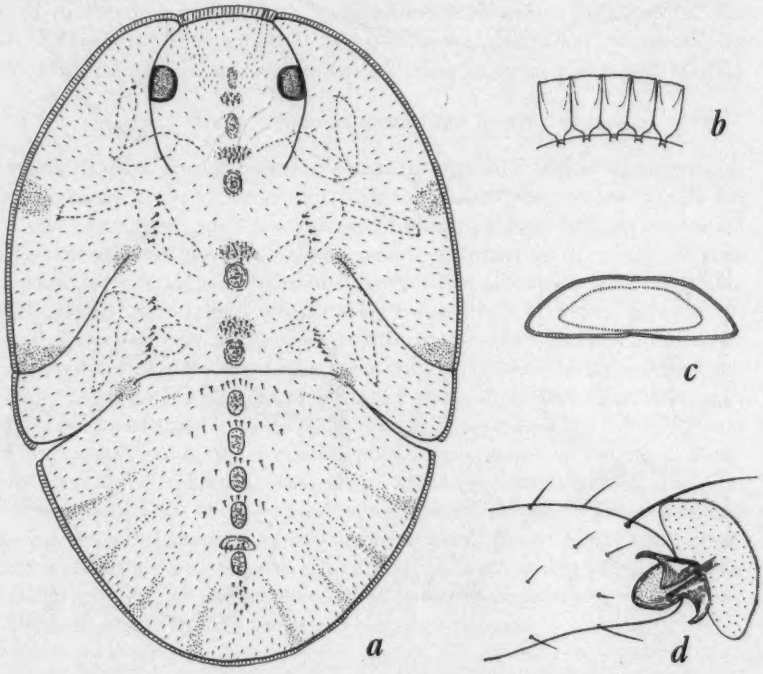

FIG. 2. Nymph of *Hemischizocranium bessi*, n. sp. *a*, dorsal aspect of last nymphal instar; *b*, detail of marginal setae; *c*, detail of anal pore ring; *d*, detail of apex of tarsus.

covering frons ventrally. Eyes, small, rounded, far down on side of head, much below plane of vertex. Antennae short, slightly longer than head. Pronotum very short, nearly as wide as mesoscutum, strongly curved back along sides of mesonotum. Forewing large, 2.5 times as long as wide, rounded apically, costa with abundant pubescence, other veins with fewer longer setae; costa very heavy; basal vein very short, base of cubitus sharply turned, cubitus and media with very short common petiole, base of Cu, M, and R very short; marginal cells and Rs very long, medial longer than cubital. Hind wing two-thirds as long as forewings, venation prominent. Apical tarsal claws much reduced, lightly sclerotized, with ventral pads. Metacoxa very short, without meracanthus. Metatibia long, stout, without basal armature, with six prominent black spines in continuous row around anterior half of apex. Proximal segment of metatarsus without claws.

Male proctiger longer than forceps, forceps simple (fig. 1, *h*, *i*). Female genital segment short, broad; ventral valve broader than dorsal; dorsal blunt, apex broadly invaginated as indicated in fig. 1, *f*, *g*.

Nymph as figured (fig. 2).

Holotype female, allotype male, numerous paratypes and nymphs, Bird Park, Kilauea Crater, Hawaii, August, 1952, H. A. Bess, collector. Type and allotype deposited in the collection of the Bernice P. Bishop Museum; paratypes in author's collection.

Recent Introductions for Biological Control in Hawaii — 1[1]

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HONOLULU, HAWAII

(*Presented at the meeting of December 12, 1955*)

The following new introductions or additional releases of beneficial organisms have been made by the Board of Agriculture and Forestry since the last listing was published ("PROCEEDINGS," 15(3):635–638, 1955). Only the first release on each island is given. Unless otherwise noted, references to previous introductions refer to earlier papers in this series.

Aerenicopsis championi Bates

This cerambycid beetle (BIOL. CEN.-AMER., COL. 5:428, 1885) which bores in the stems of lantana was introduced from Vera Cruz, Mexico. A previous attempt at introduction was made in 1902 (H.S.P.A. ENT. BULL. 16:51, 1924). It was released at Kaakepa, Hawaii, in June, 1955, and at Puu Lua, Molokai, in July.

Catabena esula Druce

An addition to the leaf-feeding insects attacking lantana, this phalaenid moth (BULL. SO. CAL. ACAD. SCI. 33:145–148, 1934) was introduced from Los Angeles, California. It was liberated at Halepiula, Hawaii, Kula, Maui, Kalaheo, Kauai, and Tantalus, Oahu, in April, 1955.

Xanthaciura connexionis Benjamin

This is a tephritid fly (U.S.D.A. TECH. BULL. 401:45, 1934) which breeds in the flower heads of pamakani (*Eupatorium glandulosum* (Humboldt, Bonpland, and Kunth)). It was discovered at Cuernavaca, Mexico. Releases were made at Iao Valley, Maui, and Tantalus, Oahu, in May, 1955.

Canthon chevrolati Harold
Canthon viridis (Palisot de Beauvois)
Phanaeus daphnis Harold
Pinotus carolinus (L.)

These dung beetles were sent from Cuernavaca, Mexico, for the control of flies and other insects breeding in dung. *Canthon chevrolati* (BIOL. CEN.-AMER., COL. 2(2):33, 1887), first introduced in 1954, was released at the

[1] This paper is a continuation of a series commenced in 1952 to record the introduction into Hawaii of insects for biological control. The title has been changed to include other groups than insects.

University of Hawaii dairy on Oahu and Molokai Ranch, Molokai, in August, 1955; in September it was liberated in Waimea, Kauai. *C. viridis* (BIOL. CEN.-AMER., COL. 2(2):30, 1887) and *Pinotus* (BIOL. CEN.-AMER., COL. 2(2): 52, 1887) were liberated on the Parker Ranch on Hawaii in November, 1954. *Phanaeus* (BIOL. CEN-AMER., COL. 2(2):61, 1887), also previously introduced in 1954, was released on Molokai Ranch in August, 1955, and in Waimea, Kauai, in September.

Campsomeris annulata (F.)
Campsomeris manokwariensis (Cameron)

These two scoliid wasps (PROC. HAW. ENT. SOC. 14(1):137, 1950) were introduced from Guam for the control of various scarabaeid grubs. They were released in the rose gardens at Koko Head, Oahu, in April, 1955.

Bracon gelechiae Ashmead

Bracon gelechiae (PROC. U.S.N.M. 11:623, 1889) was one of several parasites reared from lepidoptera infesting mesquite flowers near Tucson, Arizona. It was the only one successfully propagated on the cosmopterygid moth, *Ithome concolorella* (Chambers), which has become a serious pest on this plant in Hawaii recently. Releases of this braconid were made at Fort Shafter, Oahu, in July, 1955; Kawaihae, Hawaii, Olowalu, Maui, and Molokai Ranch, Molokai, in August; and Hanapepe, Kauai, in September. It had been introduced previously in 1945 for the control of the potato tuber moth (BOARD OF AGR. & FOR. BIENNIAL REP. 1944–46: p. 43).

Episimus sp.

This is an olethreutid moth introduced from Brazil to feed on the leaves of *Schinus terebinthifolius* Raddi, the Christmas berry tree, which has become an undesirable plant in many localities. Releases were made at Naalehu, Hawaii, in December, 1954, and Molokai Ranch in January, 1955. The first release on Oahu was made in Mikiola in October, 1955.

Gonaxis kibweziensis (Smith)

In August, 1954, about 500 snails (PROC. MALAC. SOC. LONDON 1:165, 1894) were brought from the island of Agiguan in the Marianas and released in Kaneohe, Oahu, to supplement the original stock released there in 1952 to feed on the giant African snail. In March, 1955, a colony was sent to Haiku, Maui.

Euglandina rosea (Férrusac)

This is a predacious snail of the family Oleacinidae (PHILA. ACAD. NAT. SCI. MONO. 3, 2(1):189, 1946). It was found in citrus groves in Florida and introduced to Hawaii as a predator on the African snail. Releases were made at Hauula, Oahu, in November, 1955.

Cycloneda sanguinea (L.)

In September, 1955, this aphid-feeding coccinellid was introduced from Cuernavaca, Mexico, and released on the grounds of the Board of Agriculture. The species was introduced in 1896 (Williams, THE INSECTS AND OTHER INVERTEBRATES OF HAWAIIAN SUGAR CANE FIELDS, 1931, p. 373) but failed to become established.

Octotoma scabripennis Guérin

First introduced to the Territory in 1902 (H.S.P.A. ENT. BULL. 16:10, 1924) and again in 1953, this lantana-feeding chrysomelid (BIOL. CEN.-AMER., COL. 6(2):87, 1886) was released at Kalae Ranch, Molokai, in September, 1955, and at Lawai Valley, Kauai, in November.

The undetermined species of opiine fruit fly parasites from Africa introduced in 1949 ("PROCEEDINGS," 14(2):329, 1951) have been found to be *Opius bevisi* Brues (PROC. AMER. ACAD. ARTS SCI. 61:261, 1926) and *Opius concolor* Szepligeti (BULL. SOC. ENT. FRANCE 1910, 244).

In 1953 a chalcid wasp was introduced from Kenya to control the diamondback cabbage moth ("PROCEEDINGS," 15(2):369, 1954; 15(3):636, 1955). This has been determined to be *Brachymeria boranensis* Masi (RACCOLTE ZOOLOGICHE 3:21–22, 1939).

A New Rhyncogonus From Oahu, Hawaii (Coleoptera: Curculionidae)

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(*Presented at the meeting of December 12, 1955*)

Mr. E. J. Ford, Jr., has asked me to describe a new *Rhyncogonus* weevil which he discovered near Mt. Kaala, in the Waianae Mountains of Oahu. It was at first believed that a new species had been discovered, but it appears that the new form is a subspecies of a species heretofore known only from the Koolau Mountains.

Rhyncogonus segnis fordi, new subspecies (figs. 1, 2)

Color: derm almost entirely dark piceous black; vestiture creamy white, setae apically on tibiae and on fourth and fifth ventrites more yellow.

Head with breadth measured between outer sides of eyes subequal to length along median line from posterior edges of eyes to mid point of epistome and subequal to extreme subapical breadth of rostrum; longitudinal dorsal contour, as viewed from side, flattened continuosuly with dorsum of rostrum from above hind margins of eyes; distance from pronotum to an eye, viewed from above, subequal to length of an eye; interocular area smooth and shiny, punctures larger in the shiny area and longitudinally subconfluent or confluent, thus tending to become strigose; vestiture consisting of prostrate, sharply pointed setae and squamiform setae with a patch of denser, elongate-lanceolate, more scale-like setae along upper margins of eyes, setae on crown directed forward at middle and obliquely forward in the area from behind eyes to near middle of crown, setae along upper margins of eyes directed obliquely backward and those in middle of interocular area directed straight back; setae on sides beneath eyes and to apex of sides of rostrum coarser, denser, more squamiform; eyes broadly rounded, and although obviously interrupting lateral cephalic contours, they are not unusually protuberant.

Rostrum with dorsal contour, puncturation, and vestiture continuous and similar to that of interocular area as far as the end of the dorsal flattened area, thence with a very broad, rather shallow, concave area which diverges from middle to bases of mandibles and encloses the epistomal area, this concave area with derm reticulate and punctures large and contrasting with the more

[1] This research was done at the British Museum (Natural History) during the tenure of a grant from the National Science Foundation, and I wish to express my gratitude to the Museum and to the Foundation.

shiny and less coarsely punctate epistomal area which has its anterior margin emarginate at middle.

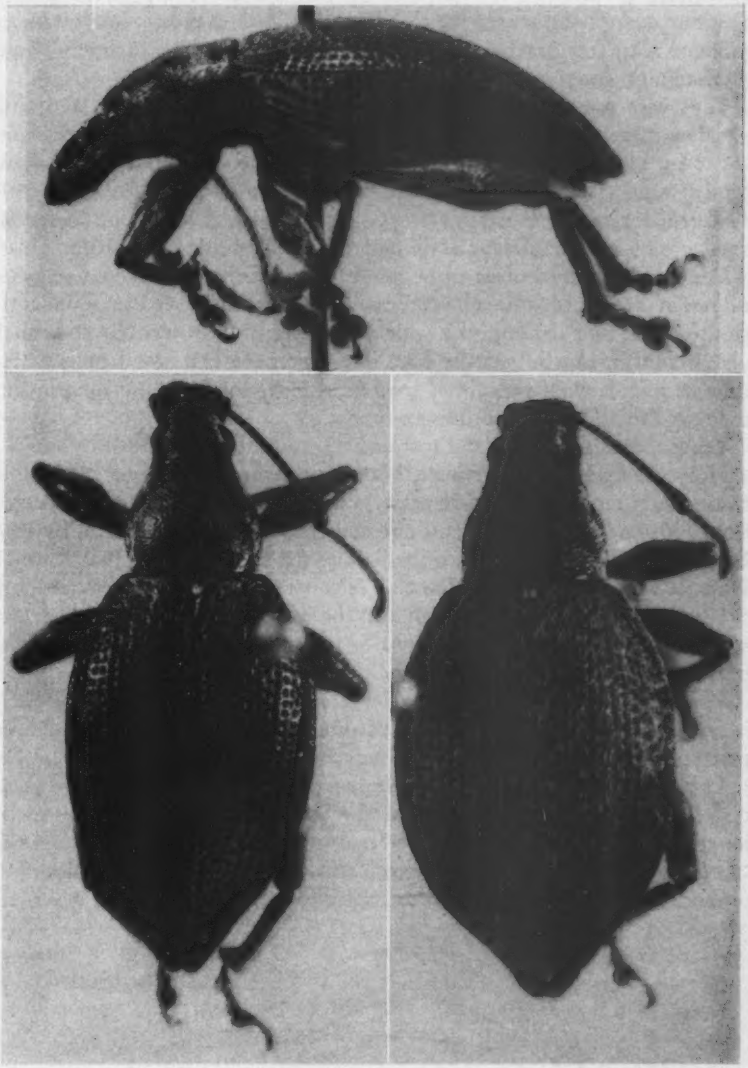
Antennae with scape clothed with long, narrow, finely acuminate, decumbent setae, none of which are squamiform, its apex capable of reaching to middle or basal third of side of pronotum (variable), as long as funicle excluding club; funicle clothed as scape, lengths of segments as follows: (1, measured on longest side, 42 micrometer divisions long) (2, 26) (3, 18 or 19) (4, 17 or 18) (5, 16) (6, 16) (7, 16); club with segments (1, 25) (2, 15) (3, 20), widest near apical part of segment two and there 13 units wide (these measurements taken with scale equaling 40 divisions to one millimeter).

Pronotum slightly transverse (34:30), broadest near middle, basal margin diluted with red, broadly and shallowly emarginate, the emargination stronger in the females examined; anterior margin very slightly and broadly emarginate at middle in females seen, not or hardly impressed in males examined; with a conspicuous and nearly continuous, bare, shiny, median line which is widest at about middle and is somewhat disturbed by, and is slightly setose in, the shallow subbasal depression; disc, excepting the median line, densely and rather coarsely punctate, the punctures tending to become confluent in some places, interspaces reticulate; punctures bearing prostrate, fine, sharply pointed setae, almost all of which are directed backward toward mid line, but the setae in the median subbasal depression are directed straight back, and the lateral margins have a broad band of denser, squamiform setae from humeri of elytra to front margin, thus forming a distinct pale stripe along each side of pronotum.

Scutellum punctate, with apical half bearing a patch of squamae similar to the squamae in the lateral vittae of pronotum.

Elytra shaped as illustrated, three times as long as pronotum; apex moderately conjointly emarginate; thinly clothed with prostrate, subsquamiform, sharply pointed, very narrowly lanceolate setae which are somewhat more conspicuous on the females; intervals five and nine, especially five, a little broader and a little more strongly elevated than the other intervals on disc; interval 13 forming the lateral margin between disc and epipleural zone, costiform and continuous with the extreme lateral interval around the elytral apex; striae shallowly impressed, punctures moderate in size, in most areas separated by two to four times the diameter of a puncture from each other, not bearing setae, arranged in regular strial lines on dorsum; derm alutaceous and rather matt; setae mostly arising from small rounded granules (view from correct angle, or the granules may appear as pits), setae all prostrate or closely decurved on dorsum except on the caudal part of declivity and especially on the costiform interval 13.

FIG. 1. *Rhyncogonus segnis fordi*, n. subsp. Top and left, holotype male, length 12.5 mm., excluding head. Female paratype at lower right, length 12.5 mm., excluding head.



Sternum with the mesosternum and metasternum punctate over all and reticulate; exocoxal area, mesepisternum, and sides of metasternum with vestiture coarser and about like that in pale stripes on pronotum, but mesepimeron with very fine hair and metepisternum nearly nude in anterior half; metasternum concave in male, slightly tumid in female.

Legs with femora clothed with prostrate or decumbent setae and with squamae rather similar to those in the pale thoracic stripes; tibiae with slanting to erect long setae and with some very long hairs scattered on inner edges; hind femora reaching fifth ventrite; femora more strongly clavate in male than female; mucrones well developed on all tibiae in male, but on female smaller on fore tibiae, vestigial on mid tibiae, and obsolescent on hind tibiae.

Venter closely punctured throughout, derm reticulate; first two ventrites tumid in the female, broadly concave in male; entire venter abundantly clothed with fine slanting hair which is denser on ventrite four and much denser and fur-like on ventrite five; suture between first two segments distinct at middle; first ventrite as long or slightly longer along median line than second and third ventrites combined.

Length, including head and rostrum: 13–14 mm.; breadth: 6–7 mm.

Holotype male, allotype female (both to be deposited in Bernice P. Bishop Museum, Honolulu), two male paratypes, and one female paratype collected from *Pelea* in August, 1954, and one male taken in October, 1954, by E. J. Ford, Jr., in the saddle of the ridge joining Mount Kaala and Puu Kawiwi, Waianae Mountains, Oahu, Hawaiian Islands, at about 2,800 feet elevation.

I have given more details than may be necessary to distinguish a subspecies, but I have done so because of the inadequacy of the original description of the typical form.

Rhyncogonus segnis segnis Perkins (PROC. HAW. ENT. SOC. 6(3):466, 1927) is not represented in the British Museum (Natural History), but a female paratype has kindly been sent for study from the Bishop Museum by Dr. J. L. Gressitt. Judging from this one female of *segnis*, it appears that *segnis* may be a more reddish form; it has the third funicular segment distinctly longer than the fourth (23:18) whereas it is subequal to four in *fordi* (18 or 19: 17 or 18). The eyes are more protuberant on *segnis*, and the pronotum is proportionately broader. There also appear to be other differences which are

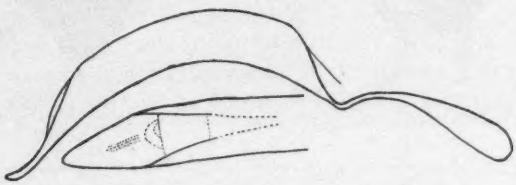


FIG. 2. Aedeagus of *Rhyncogonus segnis fordi*, n. subsp.; lateral view and dorsal view of apical part.

best appreciated by comparing specimens of the two forms. Additional specimens of *segnis* are desired for the study of the range of variation. I am unable to consider that *fordi* is more than a Waianae Mountains subspecific representative of the Koolau Mountains *segnis*.

On Dr. Swezey's map of the distribution of the *Rhyncogonus* of Oahu (PROC. HAW. ENT. SOC. 8(3):528, 1934), this form was found nearest to the locality marked "10" which denotes the supposed type locality of *Rhyncogonus funereus* Perkins, but *funereus* is a very distinct species.

I have the pleasure to dedicate this new form to Mr. E. J. Ford, Jr., in recognition of his energetic collecting in Hawaii.

Heliothis in Hawaii (Lepidoptera: Phalaenidae)

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(Presented at the meeting of December 12, 1955)

References to *Heliothis armigera* (Hübner), the corn earworm, or supposed synonyms of it, have long been present in Hawaiian literature. In 1880, Butler first listed the species from Hawaii as *Heliothis conferta* Walker, from specimens collected by Blackburn ("Bred from larvae found very rarely in company with that of *Vanessa Huntera*, on flowers of a species of 'everlasting' on Maui."; Butler, 1880:8). Although the species was long known as a notorious pest of corn and cotton in America, it was not reported as a pest of those crops in Hawaii. In 1922 (PROC. HAW. ENT. SOC. 5(2):185, 1923) Swezey reported that "The caterpillars of this moth are known as the cotton boll worm and corn ear worm in the Southern States, but in Hawaii they have not been recorded as injurious to those plants." However, by forced feeding in the laboratory, Swezey found that the caterpillars "voraciously" fed upon green sweet corn, and he stated that "It is not understood why corn in the field has not been reported attacked by these caterpillars." In 1930 corn was apparently suddenly attacked in Hawaiian fields, and subsequently corn earworms have been major pests of corn in Hawaii, and chemicals have had to be used to control them. In February, 1930, Swezey (PROC. HAW. ENT. SOC. 7(3):369, 1931) reported finding larvae in corn: "This is the first time that he had found larvae of this species attacking corn. . . ." In November, 1930, Ehrhorn (PROC. HAW. ENT. SOC. 7(3):389, 1931) reported upon the prevalence of the caterpillars on corn, and it was stated that "it had hardly been known as a corn pest here heretofore." Within the next few years, infestation became general, and at times hardly an ear of corn could be found uninfested.

This apparently unusual behaviour raised the question of whether the records for the moth in Hawaii before about 1930 were based upon correct identifications or whether the moth had suddenly changed its habits. Investigations at that time did not reveal any apparent differences of specific nature between specimens collected long before 1930 and those found damaging corn after 1930, and the differences that were observed were considered to be only individual variations in a species well known for its extreme

[1] This research was completed during the tenure of a grant from the National Science Foundation, and this paper is an extract from the project INSECTS OF HAWAII, published at this time because of the economic importance of the species involved.

variability. It was also considered that there might be two strains present in Hawaii: one, an early immigrant which was a non-corn-eating strain, and the other, introduced about 1930, a corn-eating strain.

It is now possible to report that a careful re-examination of Hawaiian specimens in the light of more experience with comparative studies of the genitalia and stimulated by the work of recent authors, has revealed that not only is *Heliothis armigera* not present in Hawaii, but that two other species are involved. One of these was named "*Heliothis obsoleta* variety *hawaiiensis*" by Quaintance and Brues in 1905, "*Chloridea obsoleta* subspecies *signata*" by Warren in 1912, and "*Chloridea armigera* ab. *hawaiiensis*" by Strand in 1916, but these names escaped the notice of Hawaiian entomologists. This is the species which has long been present in Hawaii but which is not a pest of corn or cotton. The second species, which evidently gained entrance to Hawaii shortly before 1930, is *Heliothis zea* (Boddie), described from the United States in an obscure journal rarely used for entomological reports in taxonomy, and the name *zea* has also escaped general notice. These discoveries place the apparent anomaly in Hawaii in very different light, and, of course, supply the answers to the hostplant problem.

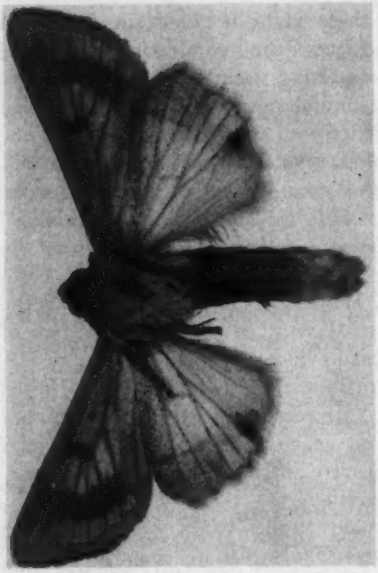
Heliothis is a complex containing many similar forms which are often difficult to separate by external characters. The two forms found in Hawaii, and others apparently allied to them or resembling them, are most easily distinguished by characters of the aedeagus. We are not able to report useful characters in the female genitalia at this time, and the genital valves of the males of the two species evidently differ only in degree rather than in major structure or shape.

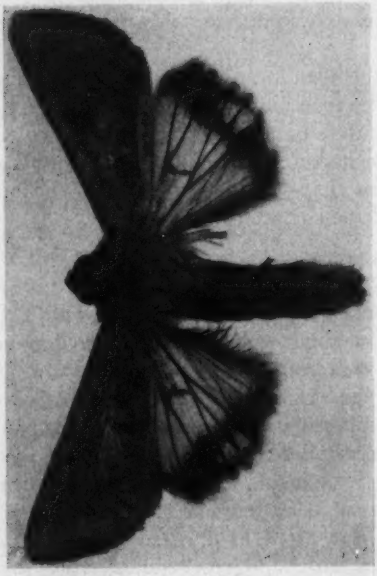
The following key will facilitate the identification of the two species established in Hawaii, but it must be borne in mind that the color pattern is subject to much variation. Not all examples of either species have the color pattern as described in the key and specimens of either species may overlap the other in some of the color pattern characters, but the species can be determined by using a combination of the characters.

Key to the Species of Heliothis in Hawaii

1. Upper side of hind wing with the dark terminal band interrupted by a usually prominent pale patch at about middle, as illustrated; lower side of hind wing with the dark terminal band obsolete and usually with only a dark spot at apex of vein Cu_2, as in figure 1; aedeagus without a subapical, thorn-like tooth, and with two clusters of long, mostly individually well-defined spines (cornuti), as in figure 3 . . . . . **zea** (Boddie)

   Upper side of hind wing with the broad, dark, terminal band usually entire and without a prominent pale patch, as illustrated; lower side of hind wing with the terminal dark band usually much more





extensive than in *zea* and usually as in figure 1 or more so; aedeagus with a well-defined, subapical, thorn-like tooth, and with a long, continuous band of more numerous, smaller, more slender spines (cornuti), as in figure 3. . . **hawaiiensis** Quaintance and Brues

The hostplant records for *Heliothis* in Hawaii must now be extensively revised, because it is impossible to tell from many of the Hawaiian reports after about 1930 which of the two species has been the object of the reports. Zimmerman has the following hostplant records in his manuscript for INSECTS OF HAWAII:

African daisy, *Ageratum*, amaranth, cabbage, carnation, carrot, Chinese pea, *Cicer arietinum* (chick pea or garbanzo), corn, cotton, cowpea, *Cyphomandra betacea* (tree tomato), eggplant, a species of "everlasting," *Euxolus*, garden bean, gladiolus, *Gossypium tomentosum*, *Heterotheca grandiflora*, *Hibiscus*, Italian gourd, Italian squash, lettuce, lima bean, *Malva*, *Malvastrum*, marigold, *Myoporum sandwicensis*, papaya, green pepper, potato, rose, *Sida cordifolia*, *Siegsbeckia*, snapdragon, Sudan grass, tomato, watermelon.

The parasites *Eucelatoria armigera* (Coquillet) (Diptera), *Frontina archippivora* (Williston) (Diptera) and *Trichogramma minutum* Riley (Hymenoptera) have been reported as being very effective, but we do not know whether they attack both species equally. The larvae of the moths are preyed upon by the wasp *Pachodynerus nasidens* (Latreille).

Heliothis zea (Boddie) (figs. 1–3)

Phalaena zea Boddie, 1850:132.
Heliothis armigera, as a misidentification.
Chloridea armigera, as a misidentification.
Heliothis obsoleta, as a misidentification.
Chloridea obsoleta, as a misidentification.

Immigrant to Hawaii. Not recorded under the name *zea* in Hawaii heretofore, but confused under other names in Hawaiian literature from 1931 onward. Accidentally introduced from North America, and evidently first established in Hawaii shortly before 1930.

Hostplants: corn, cotton, tomato and probably a large number of other hosts which have not yet been accurately determined in Hawaii.

Heliothis hawaiiensis Quaintance and Brues, new status (figs. 1–3)

Chloridea armigera "Ab. 1" Hampson, 1903:45 (described from a dark, boldly marked individual from Kona, Hawaii, 4,000 feet, July 2, 1892, Perkins).
Heliothis obsoleta variety *hawaiiensis* Quaintance and Brues, 1905:12.

FIG. 1. Top row, *Heliothis zea* (Boddie), male, expanse 39 mm. Bottom row, *Heliothis hawaiiensis* Quaintance and Brues, expanse 34 mm.

Chloridea obsoleta subspecies *signata* Warren, 1912:308 (new name for "ab. 1" of Hampson).
Chloridea armigera "ab. *hawaiiensis*" Strand, 1916:143 (Hampson's "Ab. 1," named without being seen by Strand).
Chloridea obsoleta, as a misidentification.
Heliothis obsoleta, as a misidentification.
Heliothis armigera, as a misidentification.
Heliothis conferta, as a misidentification.

Immigrant to Hawaii. It is not known when this species first became established in Hawaii. It is possible that it is a natural immigrant. We have not been able to find any specimens of the species from any region other than Hawaii, and whence it has come is not known. Judging from the evidence now at hand, it appears that the aedeagus most closely resembles that of *Heliothis gelotopoeon* (Dyar), 1921, from South America, but there may be other American species unknown to us to which it will be found more closely allied if not identical. The spines on the legs are not the same as in *gelotopoeon*, however. In the examples of that species before us, the spines are more numerous and heavy, and the outer side of the fore tibia has a comb of stout, conspicuous spines from near the base to apex which is lacking in *hawaiiensis* (the number of spines may be variable, however). Also, the valves of the male genitalia are differently shaped and longer in proportion to the aedeagus in *gelotopoeon*. Externally, *hawaiiensis* is quite similar to *zea*, and it may often be difficult to separate single examples of *hawaiiensis* from *zea*. The same comments may apply also to *armigera* which is evidently widely distributed in Eurasia and Africa. The variation in color and pattern is so extreme that an attempt to describe the coloration from the examples at hand would be incomplete and possibly misleading. Examples may be found which externally closely resemble *zea*, others *gelotopoeon*, others *armigera* or other species. It is the aedeagus which offers the decisive characters. Our illustrations will serve to establish the diagnostic features of the species as we now recognize them. Todd (1955) has also figured the genitalia of *zea* and *gelotopoeon*, and Common (1953) has figured other species.

Blackburn collected this species in Hawaii in 1880. We have been able to find three Blackburn examples in the British Museum collection. One of these was determined as "*H. conferta*," presumably by Butler. It bears the number "4." Butler (1880:8), when recording this species from the Blackburn collection, stated that the material he examined was numbered "4," and the note from Blackburn appears to indicate that the specimen was from Maui. However, the specimen bears another label reading "Hawaii, Oahu, T. Blackburn 80–31." Perhaps this example is the specimen sent by Blackburn to Butler for determination, and the note regarding the rearing of the moth from a species of "everlasting" refers to other specimens taken by Blackburn

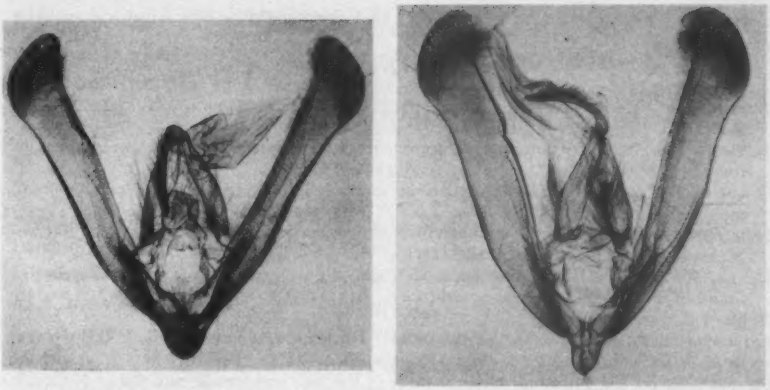


FIG. 2. Male genitalia. Left, *H. zea* (Boddie). Right, *H. hawaiiensis* Quaintance and Brues. Aedeagus removed.

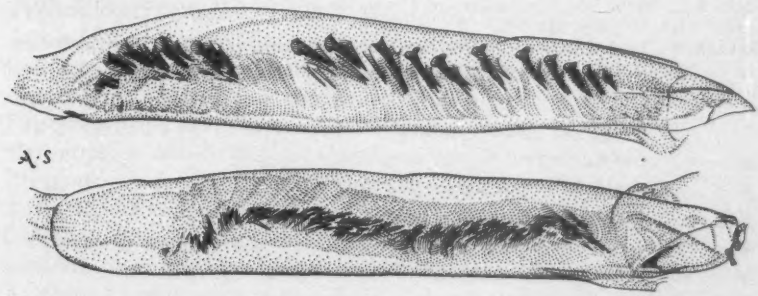


FIG. 3. Aedeagus. Top, *H. zea* (Boddie). Bottom, *H. hawaiiensis* Quaintance and Brues.

but not sent to Butler. The other two Blackburn examples are labeled *Heliothis armigera* ♂ and *Heliothis armigera* ♀; the male bears the number "141," the female "154." Evidently Blackburn placed small tickets bearing numbers on the specimens he sent for determination so that the names of the species could be returned by number, thus making the return of the specimens unnecessary.

Hostplants: a polyphagous species whose hostplants have not been accurately determined because of some confusion with *zea*, but which include a large number of the plants listed above.

In addition to the foregoing two species, *Heliothis inflata* (Wallengren) (*Anthoecia inflata* Wallengren, LEPID. MITT. 4(6):172, 1860) has incorrectly been listed as a Hawaiian species. We have examined the type in the Riksmuseum, Stockholm; it is labeled in error as having been taken in Honolulu by Kinberg. It is the same as *Anthoecia onca* Wallengren and *Anthoecia*

cystiphora Wallengren, and is a species of Central and South America and the Galapagos.

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New Insect Records for the Year 1955

Species marked with an asterisk were reported from the Hawaiian Islands for the first time in 1955 on the dates recorded in the text. Those not so marked were observed here earlier, but have only now been identified.

CHANCE IMMIGRANTS

	PAGE
*Emesopsis nubilus Uhler (Hemiptera: Reduviidae)	2
*Inostemma sp. (Hymenoptera: Platygasteridae)	2
*Hermatobates sp. (Hemiptera: Gerridae)	3
Exitianus exitiosus (Uhler) (Homoptera: Cicadellidae)	3
*Cyphoderus squamidives Silvestri (Collembola: Entomobryidae)	3
Hypurus bertrandi Perris (Coleoptera: Curculionidae)	3
*Kunzeana kunzei (Gillette) (Homoptera: Cicadellidae)	4
*Oligonychus mangiferus (Rahman and Punjab) (Acarina: Tetranychidae)	4
*Trigonotylus usingeri Carvalho (Hemiptera: Miridae)	5
Aphis fabae Scopoli (Homoptera: Aphididae)	5
*Centruroides gracilis Latreille (Scorpionida: Buthidae)	6
Ascyltus sp. (Araneida: Salticidae)	6
*Pygmaeothrips sp. (Thysanoptera: Phlaeothripidae)	7
*Halticoptera aenea (Walker) (Hymenoptera: Pteromalidae)	8
Pleurotropis detrimentosus Gahan (Hymenoptera: Eulophidae)	8
*Tetrastichus beardsleyi Fullaway (Hymenoptera: Eulophidae)	8
*Odonaspis penicillata Green (Homoptera: Diaspididae)	8
Lepidosaphes maskelli (Cockerell) (Homoptera: Diaspididae)	8
*Xyleborus semigranosus Blandford (Coleoptera: Scolytidae)	9
*Xyleborus mascarensis Eichhoff (Coleoptera: Scolytidae)	9
*Stephanoderes javanus Eggers (Coleoptera: Scolytidae)	9
*Coccotrypes carpophagus (Hornung) (Coleoptera: Scolytidae)	9
*Ericryphalus trypanoides Beeson (Coleoptera: Scolytidae)	9
*Trionymus rostellum Lobdell (Homoptera: Pseudococcidae)	10
*Habrocytus medicaginis Gahan (Hymenoptera: Pteromalidae)	11
*Ceratoxys latiuscula (Loew) (Diptera: Otitidae)	11
Araecerus levipennis Jordan (Coleoptera: Anthribidae)	11
Oligonychus indicus (Hirst) (Acarina: Tetranychidae)	12
*Schizotetranychus celarius (Banks) (Acarina: Tetranychidae)	12
*Microctonus sp. (Hymenoptera: Braconidae)	14
*Pollenia rudis (F.) (Diptera: Calliphoridae)	14
*Cricotopus bicinctus (Meigen) (Diptera: Chironomidae)	15
*Clunio tsushimensis Tokunaga (Diptera: Chironomidae)	15
Chironomus esakii Tokunaga (Diptera: Chironomidae)	15
*Dettopsomyia nigrovittata (Malloch) (Diptera: Drosophilidae)	17

*Franklinothrips vespiformis (Back) (Thysanoptera: Aeolothripidae) 17
Kurtomathrips morrilli Moulton (Thysanoptera: Thripidae) 17
*Achrysopophagus rex (Girault) (Hymenoptera: Encyrtidae) 18
Scymnus roepkei Fluiter (Coleoptera: Coccinellidae) 18
*Euchalcidia sp. (Hymenoptera: Chalcididae) 18
*Nannodastia horni Hendel (Diptera: Ephydridae) 18
*Gabucinia sp. (Acarina: Dermoglyphidae) 18
*Myobia musculi (Schrank) (Acarina: Cheyletidae) 18
*Glycyphagus domesticus (Degeer) (Acarina: Acaridae) 18
*Brevipalpus phoenicis (Geijskes) (Acarina: Phytoptipalpidae) 19
*Pelomyia coronata (Loew) (Diptera: Tethinidae) 19

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CONTENTS OF VOL. XVI, NO. 1, JULY, 1956

(Actual date of publication, July 16, 1956)

Minutes, Notes and Exhibitions PAGE

January meeting ... 1
February meeting ... 2
March meeting ... 3
April meeting ... 4
May meeting ... 5
June meeting ... 6
July meeting ... 7
August meeting ... 10
September meeting ... 13
October meeting ... 14
November meeting ... 16
December meeting ... 17

New Insect Records for 1955 ... 177

Officers and Membership for 1955 ... 179

PAPERS

BEARDSLEY, J. W.:
A New Dictyophorodelphax from Kauai (Homoptera: Delphacidae) ... 21

BESS, H. A.:
Ecological Notes on Lamprophorus tenebrosus (Walker) (Coleoptera: Lampyridae), an Enemy of the Giant African Snail ... 24

FORD, E. J., JR.:
The Genus Mirosternus in Samoa and Fiji (Coleoptera: Anobiidae) ... 30

FULLAWAY, D. T.:
New Species of Hymenoptera ... 40
Biographical Sketch of Dr. R. C. L. Perkins ... 45

GRESSITT, J. L.:
Entomological Investigations in New Guinea Mountains (Presidential address) ... 47

HARDY, D. ELMO:
Date of Publication of Volume 8, Number 1, of the Queensland Journal of Agricultural Science ... 70
New Hawaiian Sciaridae (Diptera) ... 72

MAA, T.:
Notes on the Genus Eriotremex Benson (Hymenoptera: Siricidae) ... 91

NAMBA, R.:
Descriptions of the Immature Stages and Notes on the Biology of Ithome concolorella (Chambers) (Lepidoptera: Cosmopterygidae), a Pest of Kiawe in the Hawaiian Islands ... 95
A Revision of the Balclutha Species Found in Hawaii, with Descriptions of Five New Species (Homoptera: Cicadellidae) ... 101

NEWELL, I. M.:
The New Genus Tetracondyla in the Pacific (Acari: Oppiidae) 113
A Parasitic Species of Copidognathus (Acari: Halacaridae) 122

NISHIDA, T.:
An Experimental Study of the Ovipositional Behavior of Opius fletcheri Silvestri (Hymenoptera: Braconidae), a Parasite of the Melon Fly 126

OBITUARY:
Frank Gerald Hinman 20

RICHARDS, O. W.:
A New Species of Leptocera Olivier from Hawaii (Diptera: Sphaeroceridae) 135

SHERMAN, M. and M. TAMASHIRO:
Biology and Control of Araecerus levipennis Jordan (Coleoptera: Anthribidae) .. 138

TANADA, Y.:
An Annotated List of Infectious Diseases of Insects in Hawaii. Part II 149
Size of a Granulosis Virus of Pieris rapae (L.) 156

TUTHILL, L. D.:
A New Genus of Psyllidae from Hawaii (Homoptera) 158

WEBER, P. W.:
Recent Introductions for Biological Control in Hawaii—I 162

ZIMMERMAN, E. C.:
A New Rhyncogonus from Oahu, Hawaii (Coleoptera: Curculionidae) 165

ZIMMERMAN, E. C. and D. S. FLETCHER:
Heliothis in Hawaii (Lepidoptera: Phalaenidae) 170

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